SCIENCE

8 July 1955

Volume 122, Number 3158

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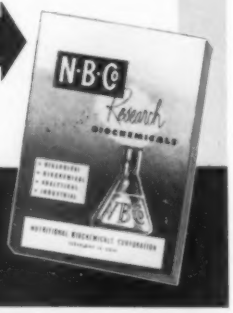

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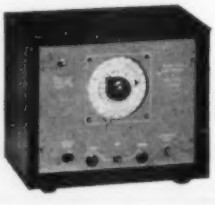

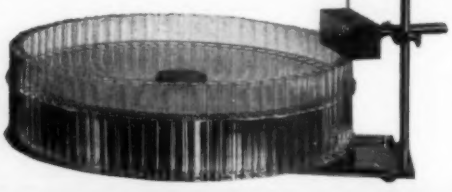

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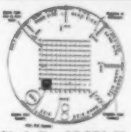

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Papers submitted by members and nonmembers of the AAAS will receive equal consideration for publication. Material that is not considered suitable for publication by the board of editors will be returned to the author, and it cannot be the subject of continuing correspondence.

1) *Lead articles.* Lead articles varying in length from about 1000 to 10,000 words are invited for consideration. These may be general articles or reviews of recent advances in some field. Authors should keep in mind the broad audience of *Science* and should employ reasonably nontechnical language that will be intelligible to most readers.

2) *Reports and Letters.* All papers that formerly were classified as "Technical Papers" and "Communications," as well as letter-to-the-editor type of comments, are now placed in one department. However, the former requirements still hold. Reports of research should be limited to four double-spaced, typewritten pages (about 1200 words). This includes the space occupied by figure or table, references, and author's name and affiliation. However, statements of conclusions without supporting data will not be accepted. *Such data should be included to the extent necessary.* Illustrative material should be limited to one table *or* one figure.

Brief announcements of completed work or observations varying in length from several sentences to approximately 600 words will usually be given priority for publication. These may be reports of significant research that will be described in detail in an archive journal. Supporting data or a comprehensive account of the work should be included in the letter of transmittal for the guidance of the referees.

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Every effort will be made to publish papers promptly. This will require the cooperation of authors, who should follow these suggestions: (i) give special attention to concise expressions; (ii) supply clear figures that unquestionably are suitable for reproduction; (iii) see that manuscripts are submitted in the form used by *Science*, especially with regard to references, figure legends, table headings, and abbreviations; (iv) on the galley proof, limit alterations to typographic and factual errors; (v) return galley proof promptly.

All manuscripts should be typed with double spacing and submitted in duplicate in order to expedite reviewing by referees and editorial processing. In the event that a paper is returned to an author for revision, one copy will be retained in the editorial office pending final disposition.

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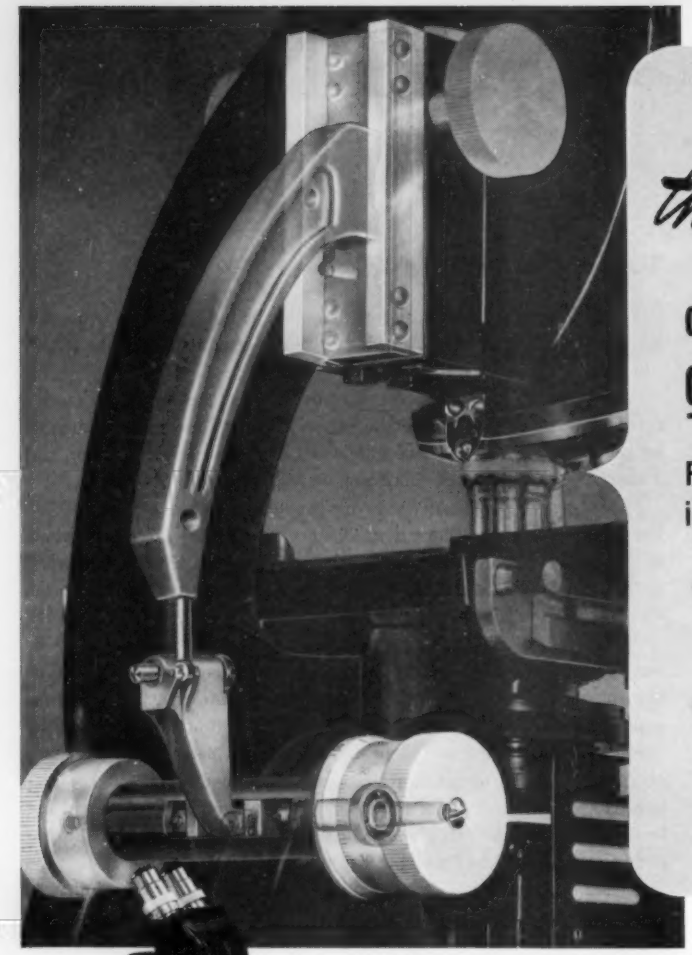

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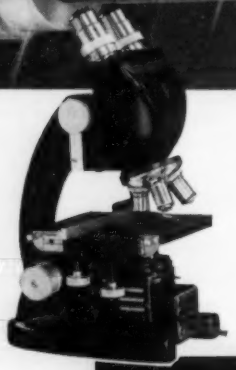

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Dosages from Natural Radioactivity and Cosmic Rays

W. F. Libby

The radiation dosages that people receive from the natural radioactivities and cosmic rays have been calculated and are given in Tables 1, 2, 3, and 4. Some direct observations are given in Table 5.

Table 1 gives the dosages in milliroentgens per year for exposures at various altitudes directly over ordinary granite, typical sedimentary rock, and open oceans. Surface dosages decrease with height above the ground because of air absorption; 50-percent reduction occurs for every 370 ft (*1*). For comparison purposes, it is interesting to note that in the United States, the average exposure *rate* from total fallout from atomic tests on 1 Jan. 1955, was about 1 mr/yr (*2*). The total dose during 1954 probably averaged about 15 mr (*2*), principally because of the Pacific tests in the spring.

The values listed in Table 1 were calculated on the following basis. The roentgen was taken to be 100 ergs of energy per gram of water. (Actually this definition is that of the rad, the internationally recognized unit of radiation dosage. For gamma rays it is nearly equal to the roentgen, which is 93 ergs/g.) The absorption coefficients of all radiations in tissue were taken as being equivalent to those of water. The dosages from the natural radioactivities in the earth were calculated on the approximation that the energy absorbed per gram by the human body on the surface of the earth is, to a sufficient approximation, equivalent to that absorbed per gram by the top layers of the rock of the earth's surface itself from the gamma radiation emitted by the rock (*3*). In other words, the total gamma-ray energy produced in a gram of granite from the thorium, uranium, and potassium contained was taken to be equal to the energy absorbed per gram of human tissue in the human body on the surface, except that a factor of 2 was used to correct for the geometric loss. It was interesting to observe that this simple method of calculation gave results in good agreement with those based both on separate consideration of each of the complicated radiations emitted by thorium and uranium in the rocks and on the use of the individual absorption coefficients for these radiations in tissue, together with correction for the "build-up" factors as the radiation is scattered and diffuses out of the rock (*4*).

The abundances of uranium, thorium, and potassium in granite were taken as 4×10^{-6} g/g (*1*), 13×10^{-6} g/g (*1*), and 0.03 g/g, respectively (*1*). In selecting these numbers, it was realized that these were only averages and that fluctuations around these values do occur, that uranium contents as high as 200 ppm have been found in granite, and that thorium has been found as abundant as 500 ppm in some granites.

For sedimentary rocks, the general average figure of one-fourth of the values quoted for granites has been used. It is realized, however, that this is very approximate, because the amounts of the various radioactive minerals in the sedimentaries fluctuate widely. The abundances of uranium and potassium in sea water were taken, respectively, as 1.3×10^{-9} g/g (*1*) and 3.5×10^{-4} g/g (*1*). The abundance of potassium in the human body was taken as 2×10^{-3} g/g (*5*), and the abundance of carbon in the human body was taken as 18 percent. For the calculation of the dosage from radium assimilated in drinking waters throughout the normal lifetime, the bone weight was taken as 10 percent for the adult man. But for relatively brief periods of assimilation when the radium would be expected to be concentrated in the small volumes of the bone most metabolically active, the figure of 1 percent was used. All these numbers on the human body were taken as being equivalent to those of the "standard man" (*6*).

The dosages resulting from cosmic radiation were calculated from the ionization chamber data of Millikan *et al.* (*7*). From these data the dosages were calculated at altitudes up to 20,000 ft and at the latitude of 55°N (geomagnetic) as well as at the geomagnetic equator. The results are given in Table 2. It should be mentioned that the biological effects per unit energy may be larger for cosmic radiation, because it consists of high-energy particles rather than gamma radiation.

The natural radioactivity in the human body contributes the dosages given in Table 3. Of the 19-mr/yr dosage from potassium, 17 mr/yr is from the beta rays of the potassium itself. These were taken to be of a mean energy 40 percent of the maximum energy of 1.36 Mev. The specific activity of natural potassium was taken as 1800 beta rays per gram, per minute and 180 gamma rays of 1.45-Mev energy per gram, per minute (*8*). The gamma rays that contribute the remaining two units of the dosage of potassium were calculated on the basis of the assumption that only half of the gamma-ray energy is actually absorbed in the body. This leads to the result that in a packed crowd the radioactivity from the potassium in one's neighbors' bodies contributes an additional dosage of 2 mr/yr.

The dosage from carbon was calculated on the basis of the assumptions that the body is 18-percent carbon; the specific radioactivity of carbon is 15 disintegrations/g, per minute (*9*); and that the mean energy of the beta radiation is 40 percent of the maximum energy of 167 kev (*8*).

In Table 4, various ordinary but somewhat unusual circumstances are used to illustrate the types of exposure that can occur in normal living. A wrist watch worn 24 hr/day that has a luminous dial assumed to have 1 μc of radium per watch—a figure perhaps slightly larger than the average—would give the central body, including the sex organs, a dosage of about 40 mr/yr. An airplane pilot flying 24 hr/day with an instrument panel consisting of 100 dials with 3 μc of radium each would receive, at an aver-

The author is a member of the U.S. Atomic Energy Commission.

Table 1. Total radiation dosages from normal background radiation (mr/yr)

Altitude of ground surface (ft)	Ordinary granite		Typical sedimentary rock		Open ocean	
	Equator	55°N	Equator	55°N	Equator	55°N
Sea level	143	147	76	80	53	57
5,000	150	170	83	103		
10,000	190	230	123	163		
15,000	270	350	203	283		
20,000	414	560	347	493		

age distance of 1 yd, a dosage of 1300 mr/yr.

In order to check whether the dosages calculated here and given in Tables 1 to 4 are essentially correct, some direct measurements reported by various observers are given in Table 5. They agree reasonably well with the external component of the total dosages given for sea level in Table 1—the residues after subtracting 20.5 mr/yr, the dosage from body radioactivities given in Table 3.

It is interesting that the variations in natural dosage are large and under certain conditions the natural dosage may be nearly 100 times higher than the minimum—the dosage of seafarers. The fallout dosage rate in the United States on 1 Jan. 1955—1 mr/yr—was only 2 percent of this lowest natural dosage rate. Of course, during a test period when bombs are fired, the fallout dosage rates may approach, or somewhat exceed, the natural dosage rate for a few days before decay and weathering processes reduce them in a few weeks to rates that are small percentages of the natural background.

Table 2. Cosmic ray dosages

Altitude (ft)	Dosages (mr/yr)
Sea level	33 to 37
5,000	40 to 60
10,000	80 to 120
15,000	160 to 240
20,000	300 to 450

Table 3. Radiation dosages from the natural radioactivity of the human body

Source of radioactivity	Dosage (mr/yr)
Potassium	19
Carbon	1.5
Radium (bones only), uniform distribution	6.7
Radium (bones only), nonuniform distribution	67*

* The radium content of the human body is based on data of A. F. Stehney of Argonne National Laboratory.

References and Notes

1. H. Faul, *Nuclear Geology* (Wiley, New York, 1954).
2. M. Eisenbud and J. H. Harley, *Science* 121, 677 (1955).
3. This calculation was kindly suggested by L. D. Marinelli of Argonne National Laboratory.
4. U. Fano, *Nucleonics* 11, No. 8, 8 (1953); 11, No. 9, 55 (1953).
5. L. D. Marinelli, private communication.
6. "Recommendations of the International Commission on Radiological Protection," *NBS Handbook No. 47* (1950), p. 16.
7. R. A. Millikan and H. V. Neher, *Phys. Rev.* 50, 15 (1936); H. V. Neher and W. H. Pickering, *ibid.* 61, 407 (1942).
8. "Nuclear Data," *Natl. Bur. Standards U.S. Circ. 499* (1950), suppl. 1, 2, and 3.
9. W. F. Libby, *Radiocarbon Dating* (Univ. of Chicago Press, Chicago, 1952).
10. A. H. Sturtevant, "Genetic effects of high-energy irradiation of human population," address given 11 Jan. 1955 at California Institute of Technology.
11. R. M. Sievert and B. Hultquist, "Variation in natural gamma radiation in Sweden," *Acta Radiol.* 37, 388, 399 (1952).
12. F. P. Cowan, "Everyday radiation," *Phys. Today* 5, No. 10, 10 (1952); also AECU-1138.
13. V. F. Hess and R. P. Vancour, "Ionization balance of the atmosphere," *J. Atm. and Terrest. Phys.* 1, 13 (1950).
14. P. R. J. Burch and F. W. Spiers, "Radioactivity of the human being," *Science* 120, 719 (1954); P. R. J. Burch, "Cosmic radiation," *Proc. Phys. Soc. London* A67, 421 (1954).

Table 4. Radiation dosages in various ordinary circumstances

Radiation source	Location	Dosage (mr/yr)
Wrist watch (1 μc of Ra per watch)	Central body, including sex organs, at average distance of 1 ft	40
Luminous dials in airplane cabin (100 dials with 3 μc of Ra each)	Pilot is taken to be at an average distance of 1 yd from the dials	1300
X-rays (*10*)	Lumbar spine, anterior-posterior	1500 each
	Lumbar spine, lateral	5700 each
	Pregnancy, anterior-posterior	3600 each
	Pregnancy, lateral	9000 each
Uranium ore (0.1 percent—the minimum accepted by the AEC for purchase)	Flat surface ground	2800
	Mine with all walls of ore	5600 (neglecting radon)
Phosphate rock (commercial fertilizer 0.01 to 0.025 percent U)	Flat surface ground	280–700
People	Packed in crowd	2

Table 5. Experimental data for hard background radiation (mr/yr)*

Observer	Cosmic rays	Gamma rays		Cosmic and gamma rays (total)	Location
		From air	From ground		
Sievert and Hultquist	44			121–150	Streets of Stockholm
				104–182	Over igneous rocks, Sweden
				94	Clay soil (*11*)
				104	Wood houses (average center of room)
				145	Brick and concrete houses (types 1, 2) (*11*)
				296 (max., 520)	Brick and concrete houses (type 3) (*11*)
Cowan				98	Outdoors, Brookhaven, N.Y., measured (*12*)
Hess and Vancour	34	2	53	90	Outdoors, Fordham Univ. campus, N.Y., 1 m above ground (*13*)
Burch	31–34		62	94–96	Leeds, England (*14*)

* Kindly collected by L. D. Marinelli of Argonne National Laboratory.

Proposal for Distribution of a Hemoglobin Standard

R. Keith Cannan

There is probably no procedure more commonly used in clinical laboratories than hemoglobinometry and few that are less satisfactory in their results. The deficiencies may reside, in part, in inadequacies of the chosen method. In larger part, however, they result from manipulative errors in the measurement and processing of the samples of blood. The latter involve questions of technical proficiency that are entirely within the control of the analyst himself. When, however, he converts his observations—gasometric or photometric readings, measurements of specific gravity, and so forth—to grams of hemoglobin in 100 ml of blood, he must depend upon his own calibration or a calibration supplied by an instrument maker, both procedures involving a conversion factor taken from the literature.

To be satisfied that the calibration remains valid for the instrument, reagents, and technical routines in use in his laboratory, he should periodically undertake a precise and time-consuming series of standardizations. If a uniform hemoglobin standard were available nationally and if a single method of analysis were widely practiced, the individual laboratory would then have assurance not only that its results would be comparable from month to month but that they would also be comparable with those from other laboratories employing the same standard. Inconsistencies in results that persisted under these conditions could then be clearly attributed to technical and manipulative errors.

The purpose of this report (*1*) is to describe a plan for the distribution of a certified hemoglobin standard and to advocate the wide adoption of a recommended analytic procedure. The use of both the new procedure and the standard is recommended. At the same time it is pointed out that the standard may be employed for the calibration of other methods of hemoglobin analysis in laboratories that do not choose to adopt routinely the advocated photometric procedure.

In 1941 the British Medical Research Council instituted an extensive study of the problem of standardizing hemoglobinometry and emerged with (i) a recommended analytic procedure, (ii) a simple hemoglobinometer for general use, and (iii) a certified national hemoglobin standard for distribution to cooperating laboratories (*2*).

In the United States the initiative was taken by the Army Medical Service Graduate School with a limited field trial (*3*) of a cyanmethemoglobin solution proposed by David L. Drabkin. The success of the Army plan so impressed the Hematology Study Section of the National Institutes of Health that it requested the National Research Council to explore the possibility of establishing a national hemoglobin standard for general use throughout the country.

To this end the NAS–NRC established an *ad hoc* panel under the subcommittee on blood and related problems of the Division of Medical Sciences. This panel has sought the cooperation of the College of American Pathologists, the American Society of Clinical Pathologists, the American Association of Blood Banks, the Department of Defense, the Veterans Administration, the National Institutes of Health, and the National Bureau of Standards. It has also maintained close liaison with the committee on hemoglobinometry of the Medical Research Council of the United Kingdom and with the National Research Council of Canada.

The panel gave serious consideration to the British plan but decided that, in respect to simplicity and adaptability, the cyanmethemoglobin method (*4–6*) adopted by the U.S. Army would be more suitable for use in the United States and Canada. It was agreed that the choice of a solution of some form of hemoglobin as a standard for hemoglobinometry was both logical and direct. In contrast to a glass standard, it would have the advantage of adaptability to a variety of photometric instruments and cuvettes. Among the forms of hemoglobin well adapted to photometry, cyanmethemoglobin has outstanding advantages. It has been shown that solutions of this pigment are stable for years when they are preserved at refrigerator temperatures (*7*). The absorption band of cyanmethemoglobin in the region of 540 mμ is broad rather than sharp, so that its solutions are suitable for use in filter-type photometers as well as in narrow-band spectrophotometers (*5, 8*). Finally, all forms of hemoglobin likely to be found in blood, with the exception of sulfhemoglobin, are quantitatively converted to cyanmethemoglobin upon the addition of a single reagent (*5*).

Recommendations

On the basis of these considerations, the panel reached agreement on the following recommendations.

1) There shall be a standard of reference in the form of a preparation of crystalline human hemoglobin prepared by the method of Drabkin (*9*). The acceptable criteria for this preparation shall be that a solution containing 1 milliatom of hemoglobin iron per liter shall have a millimolar extinction coefficient of 11.5 at a wavelength of 540 mμ, when measured as cyanmethemoglobin (*5, 8*). Certification of this standard of reference shall rest upon the results of spectrophotometric measurements and of analyses for iron made independently by the National Institutes of Health, the Army Medical Service Graduate School, the National Bureau of Standards, and Drabkin's laboratory at the University of Pennsylvania.

E. J. King of the Postgraduate Medical School in London will also characterize the standard of reference both chemically and spectrophotometrically and compare the results of its use with determinations of hemoglobin employing the British standard.

2) The iron content of hemoglobin shall be accepted to be 0.335 percent (*10*). This value for iron is the traditional figure used in this country and is in substantial agreement with that adopted by the British. It corresponds with an equivalent weight for hemoglobin of 16,700 per atom of iron and with an oxygen capacity of 1.34 ml per gram of hemoglobin (*10*).

The adoption of an agreed figure for the iron content is necessary in order that the spectrophotometric measurements in terms of iron may be translated into grams of hemoglobin. Should any change be made in the future in the accepted values for the extinction coefficient of cyanmethemoglobin and the iron content of hemoglobin, results based on the use of the afore-mentioned standard may be readily recalculated.

3) There shall be a standard for distribution in the form of a certified solu-

This plan was drafted by the *ad hoc* Panel on the Establishment of a Hemoglobin Standard of the Division of Medical Sciences, National Academy of Sciences-National Research Council. Dr. Cannan is chairman of the Division of Medical Sciences.

tion of cyanmethemoglobin that shall be prepared directly from the standard of reference. The standard for distribution shall be packaged as three separate solutions containing certified concentrations of approximately 20, 40, and 60 mg of hemoglobin in the form of cyanmethemoglobin per 100 ml of solution.

These three solutions will correspond to 1 to 250 dilutions of blood containing approximately 5, 10, and 15 g, respectively, of hemoglobin per 100 ml of solution. After bottling, samples of these standard solutions will be spot-checked for correctness of optical density by the four analytic laboratories that have been designated in recommendation 1. The batch will then be certified and distributed to cooperating laboratories by designated national agencies.

4) In conjunction with the use of the proposed standards, it is recommended that clinical laboratories consider the adoption of the cyanmethemoglobin method of hemoglobin determination described by Drabkin.

The use of the cyanmethemoglobin method follows from the concept that it would be logical to adopt a method of analysis that converts hemoglobin into the same pigment as that used in the standard. It does not, however, preclude the use of the cyanmethemoglobin standard for the calibration of other methods of hemoglobin analysis that may be in routine use in some laboratories. However, it should be realized that such a procedure may lead to some loss of accuracy.

The cyanmethemoglobin method employs a single solution containing potassium ferricyanide and potassium cyanide, which converts the hemoglobin in blood quantitatively to cyanmethemoglobin. The ferricyanide converts the hemoglobin iron from the ferrous to the ferric state to form methemoglobin, which then combines with potassium cyanide to produce the stable pigment cyanmethemoglobin. These two reactions are rapid and stoichiometric.

There should be no reluctance to employ this standard and reagent because they contain cyanide. The concentration of cyanide in the reagent that is proposed for use is only 50 mg of potassium cyanide per liter. Its lethal dose for man approaches 4 lit (*11*). Most clinical laboratories use, for the determination of uric acid, a reagent containing 50 g of this salt per liter. In view of this and of the fact that laboratories of clinical pathology are disciplined in the use of such dangerous materials as isotopes and virulent pathogens, it would seem that the handling of the proposed reagent constitutes a quite negligible hazard.

Field Trial

The panel also agreed to undertake a 1-yr field trial of the standard for distribution described in recommendation 3. It is now felt that the plans for this field trial have progressed to the point where the participation of laboratories desiring to cooperate may be invited. The standards, which are prepared by Drabkin, are being distributed without charge to clinical laboratories on application, provided that the applicants agree to meet the following minimum requirements for participation: (i) to conduct and report at 3-mo intervals, for 1 year, measurements of the actual photometric readings of the three standard solutions in the photometer routinely in use for hemoglobin measurements in that laboratory; (ii) to cooperate in answering a simple questionnaire designed to furnish information on the influence of various factors on the results of the hemoglobin determinations that will assist the panel in its long-range plans for making the standard available on a national scale; (iii) to cooperate in the analysis and reporting of an unknown solution of cyanmethemoglobin and an unknown sample of blood.

The standard for distribution, consisting of the three solutions described in recommendation 3, is packaged as a single unit. Details of the procedure for the determination of hemoglobin as cyanmethemoglobin, as well as details of the procedure for calibrating another method in terms of the cyanmethemoglobin standard, are furnished with the standard.

Distribution is made to civilian laboratories by the College of American Pathologists, 203 N. Wabash Ave., Chicago, Ill.; to military and government laboratories by the Army Medical Service Graduate School, the Navy Bureau of Medicine and Surgery, the Air Force Surgeon General's Office, and the Veterans Administration; and to laboratories in Canada through the Division on Medical Research, National Research Council, Ottawa, Ont. Cooperating laboratories are requested to apply to the distributing agency with which they are most closely associated. Because of limitation in the number of sets of the standard available, distribution is determined by priority of application and willingness to comply with the conditions listed. It is assumed that application for standards indicates acceptance of these conditions. Distribution of the standard began 1 July.

References and Notes

1. Presented in part at the meeting of the American Association of Blood Banks, Washington, D.C., September 1954.
2. E. J. King and M. Gilchrist, "Determination of haemoglobin. I. Determination by a cyanhaematin method," *Lancet* **2**, 201 (1947); E. J. King, M. Gilchrist, A. Matheson, "The haemoglobin equivalent of the B. S. I. Haldane standard," *Brit. Med. J.* **1**, 250 (1944); E. J. King *et al.*, "Determination of haemoglobin. II. Haldane haemoglobin standard compared with iron and gasometric estimations," *Lancet* **2**, 789 (1947); E. J. King *et al.*, "Determination of haemoglobin. VI." *Lancet* **2**, 971 (1948).
3. W. H. Crosby, J. I. Munn, F. W. Furth, "Standardizing a method for clinical hemoglobinometry," *U.S. Armed Forces Med. J.* **5**, 693 (1954).
4. W. C. Stadie, "A method for the determination of methemoglobin in blood," *J. Biol. Chem.* **41**, 237 (1920).
5. D. L. Drabkin and J. H. Austin, "II. Preparations from washed blood cells; nitric oxide hemoglobin and sulfhemoglobin," *ibid.* **112**, 51 (1935–36).
6. K. A. Evelyn and H. T. Malloy, "Microdetermination of oxyhemoglobin, methemoglobin, and sulfhemoglobin in a single sample of blood," *ibid.* **126**, 655 (1938); F. W. Sunderman, "A note on the use of a permanent standard for hemoglobin measurements," *Am. J. Clin. Pathol. Tech. Suppl.* **7**, 1 (1943); H. B. Collier, "Standardization of blood haemoglobin determinations," *Can. Med. Assoc. J.* **50**, 550 (1944); E. J. King, M. Gilchrist, G. E. Delory, "Accuracy of haemoglobin determinations," *Lancet* **1**, 239 (1944).
7. D. L. Drabkin, personal communication.
8. D. L. Drabkin and J. H. Austin, "I. Spectrophotometric constants for common hemoglobin derivatives in human, dog, and rabbit blood," *J. Biol. Chem.* **98**, 719 (1932).
9. D. L. Drabkin, "XIV. Crystallographic and optical properties of the hemoglobin of man in comparison with those of other species," *ibid.* **164**, 703 (1946); "Simplified technique for a large scale crystallization of human oxyhemoglobin. Isomorphous transformations of hemoglobin and myoglobin in the crystalline state," *Arch. Biochem.* **21**, 224 (1949); "XV. Hydration of macro-sized crystals of human hemoglobin, and osmotic concentrations in red cells," *J. Biol. Chem.* **185**, 231 (1950).
10. G. Hufner, "Neue versuche zur bestimmung der sauerstoffcapacitat des blutfarbstoffs," *Arch. Anat. Physiol. Physiol. Abt.* **130** (1894).
11. T. H. Sollmann, *Manual of Pharmacology* (Saunders, Philadelphia, ed. 7, 1948), p. 713.

Let no youth have any anxiety about the upshot of his education, whatever the line of it may be. If he keeps faithfully busy each hour of the working-day, he may safely leave the final result to itself. He can with perfect certainty count on waking up some fine morning to find himself one of the competent ones of his generation, in whatever pursuit he may have singled out.—WILLIAM JAMES, *The Principles of Psychology.*

Recommendations for Development of Arid Lands

International Arid Lands Conference

The International Arid Lands Meetings opened at the University of New Mexico in Albuquerque the evening of 26 April with a symposium composed of three public evening lectures and four technical sessions. The technical sessions, in harmony with the theme of the meetings—"What is the future of arid lands?"—explored possible lines of future research and development in the subject-areas of (i) variability and predictability of water supply in arid regions; (ii) better use of present resources; (iii) prospects for additional water sources; and (iv) better adaptation of plants and animals to arid conditions. These sessions featured papers by experts from all parts of the world and open discussion from the floor. An additional day was devoted to informal discussion by 12 groups, each of which focused on a specific problem of arid-land development. Material from the symposium papers and from the discussions served as a pool of ideas from which problems to be considered at a conference held 2–4 May were selected. The conference took place at New Mexico Institute of Mining and Technology in Socorro.

A 2-day field trip through southwestern New Mexico gave the conference participants an opportunity to get better acquainted, to discuss problems and exchange experiences in an informal way, and to observe an arid region of the United States and the measures used to increase its productivity.

The Socorro conference, composed of 71 participants from 18 countries, had as its purpose the exchange of views and the formulation of recomendations for future lines of research and development for the arid zones of the world.

The first day was devoted to a review and evaluation of the problems and development of the Rio Grande Valley as a typical arid area and of problems and procedures involved in planning and conducting integrated surveys of semiarid and arid zones.

On the second day, the conference separated into three working groups with the following general assignments: new approaches needed in meteorology and applied climatology; the concept of the water budget and its areal application; and closing the gap between scientific knowledge and its application to arid-lands development. Each group formulated a series of recommendations to be considered by the conference as a whole on the final day. The conference considered each recommendation, combined, modified, and clarified some, and approved those that follow.

The International Arid Lands Meetings and Conference were sponsored by the American Association for the Advancement of Science and the Southwestern and Rocky Mountain Division, AAAS, and were supported by the National Science Foundation, the Rockefeller Foundation, and the United Nations Educational, Scientific, and Cultural Organization.

Anthropology and Archeology

1) A bibliography of our present knowledge of biological adaptations of man and of the cultural patterns in arid climates, past and present, is needed to promote specific research in these areas. Such research would contribute to the betterment of living conditions and to planning for greater safe use of arid areas.

2) Further research, in addition to the diffusion of information, is needed concerning the history of land use, especially agriculture, in arid and semiarid regions. Information in this field has practical applications in land-use planning, and our present knowledge is very sketchy. The UNESCO Advisory Committee on Arid Zone Research is urged to consider means of furthering research on this subject and to consider the publication of a volume dealing with agriculture of the past in the arid and semiarid lands of the world.

3) Exploration is needed of possible new patterns of resource use and practice with local participation in the studies to insure the public understanding so necessary for achieving any change, even on a gradual basis. There is a tendency to encourage the maintenance of existing patterns, even when it is realized that existing patterns have been inherited from conditions quite dissimilar to those of the present. Land-use histories may be valuable in dramatizing climatic hazards; there is need for long-term improvement in management; and even statistical data on climatic change can be effectively and convincingly presented if they are properly organized.

Meteorology and Climatology

4) The conference notes with satisfaction the recent action of the UNESCO Advisory Committee on Arid Zone Research in planning to devote the next arid-lands symposium to climatological problems of arid lands and urges sponsorship of continued research of arid-land climatology by the committee.

5) It is recommended that the program of the International Geophysical Year, which previously emphasized polar observations, be extended in 1957–58 to include, to the maximum extent possible, the arid belt of the world, and, in addition, that arid-zone countries involved be asked to participate in this program. Although the original plan of the International Geophysical Year has been expanded, the vast arid and semiarid areas of Africa, Asia, Australia, North America, and South America—30°N to 30°S principally—are still poorly represented in the list of longitudinal and latitudinal sections fixed for intensive observations.

The observations of solar radiation and of other meteorological elements on the surface and in the upper atmosphere in the arid countries, and specifically along a parallel of latitude through as many as possible of the world's deserts, should be useful in the solution of arid- and semiarid-zone problems. Intensification of observations at the national level will enable arid-zone countries to benefit even more from the international aspects of the International Geophysical Year.

6) More effective climatic studies require an increase in density and improvement in representativeness of meteorological stations (both at sea level and at higher elevations) for surface and upper-air observations in all arid areas.

7) Careful attention should be paid to current research studies concerning relationships of solar emanations and terrestrial weather patterns, with particular attention to the effects that may bear on arid-land problems.

8) Synoptic and dynamic climatological studies, in different arid and semiarid regions, are essential. Emphasis should be placed on interrelationships between the general circulation of the atmosphere at upper levels as well as at the surface and the precipitation in different parts of the areas and at different times of the year. With such studies as a basis for the development of understanding, prediction of precipitation within the area in question may follow.

Foreign participants in the International Arid Lands Conference. Left to right (back row) Mahmoud A. El-Ashkar (Egypt), Hilgard O'Reilly Sternberg (Brazil), B. P. Uvarov (England), Thomas C. Lermanda (Chile), Pedro Armillas (Mexico), N. L. Nicholson (Canada), Aldert Molenaar (FAO, Italy), James A. Swarbrick (UNESCO, France); (middle row) C. S. Christian (Australia), Carlos Muñoz (Chile), Rodolfo E. G. Pichi-Sermolli (Italy), Herbert Greene (England), S. N. Naqvi (Pakistan), C. C. Wallén (Sweden), E. G. Bowen (Australia), Georges Aubert (France), Enrique Beltrán (Mexico), Hugo Boyko (Israel), W. F. J. M. Krul (Netherlands), Theodore Monod (Senegal), Soubhi Mazloum (Syria); (front row) Omar Draz (Egypt), Kanwar Sain (India), E. M. Fournier d'Albe (Mexico), B. T. Dickson (Australia), F. Dixey (England), Michael Evenari (Israel), Jean Tixeront (Tunis).

9) Inasmuch as the matter of the evaluation of the results following attempts to modify weather and weather processes is recognized as offering great possibilities for the peoples of arid lands, every effort should be made to develop improved techniques for statistical evaluation of weather-modification experiments and to use the best available present techniques and data in the analysis of the results of such experiments.

10) An international cooperative program of synoptic observations should be instituted to determine the concentration of ice-forming nuclei throughout the world, especially during periods of the earth's passage through meteoritic streams. These observations should be supplemented by measurements, synoptic if possible, of the concentration of naturally and industrially induced condensation nuclei (including giant hygroscopic nuclei) by studies of the chemical composition of precipitation and by the conduct of cloud surveys.

11) A more vigorous study of all possible aspects of periodic cloud seeding is imperative.

12) Present knowledge of nucleation properties of silver iodide as affected by the methods of generation and dispersal is inadequate. Further studies, with particular reference to the decay of silver iodide's nucleating activity with increasing time of exposure in the atmosphere, are recommended.

13) Closer integration of the sciences of climatology and hydrology can be fostered through better exchange of information and collaborative analyses aimed at improving joint methodology. The lack of such collaboration between climatologists and hydrologists has contributed in the past to inadequate estimation of available water resources in some arid-zone projects.

Recommendations 17, 19, 25, and 29 are also applicable.

Hydrology, Geology, and Soils

14) The importance of ground water in arid zones calls for continued research on the following aspects of this subject: (i) methods of exploration and estimation of the volume of ground-water bodies; (ii) methods of increasing ground-water recharge and of estimating rates of recharge; (iii) the relation of vegetation and other biological factors to ground-water recharge; (iv) the geomorphological aspects of the occurrence and chemistry of ground water.

15) The precipitation occurring on drainage basins should not be regarded in terms of utilization for irrigation alone, and more consideration should be given to planning for the beneficial use of water that is not reaching points of downstream use.

16) Continued study is needed of the factors and practices modifying soil structure under various land-use practices, such as grazing, dry-land farming, and irrigation farming, recognizing the importance of soil structure and its maintenance in relation to permeability and to prevention and abatement of erosion.

17) The work of hydrologists and climatologists would benefit greatly by the fullest possible use of vegetation studies, specifically by the consideration of the role of vegetation as a factor in the hydrology of dry lands and of plant species and communities as indicators of climates, past and present.

18) Further attention should be given to the study of the geomorphic dynamics of landscapes for application to regional

and land-type appraisal and land-use planning.

Also see recommendations 13, 21, 25, 28, and 30(ii).

Biology, Ecology, and Conservation

19) Intensive studies of the microclimatic environments of plants and animals should be encouraged and pursued. The relationships between the data usually recorded by meteorological stations and the microclimatic effects of these phenomena in different sections of typical arid environments should be subjected to intensive study.

20) Research on plant and animal ecology, improvement, and management in arid areas should be intensified. Emphasis should be placed on preadapted species and races, on understanding of the physiological factors in the selection of characteristics desired in breeding, on water requirements of the various species and breeds as related to production, and on utilization of available soil and climatic resources by plants and of available vegetation by various species and breeds of animals.

21) Additional research is needed on the methods of determination and the estimation of the water requirements of plants in arid regions, especially on the efficiency of transpiration, the relationship between transpiration and photosynthesis, and the regulation of transpiration. The suggestion is made to the UNESCO Advisory Committee on Arid Zone Research that it compile a review of information and research studies currently available on this subject.

22) Intensified research should be undertaken, and research results should be applied in the management of grazing, because of the paramount importance of grazing management in the conservation and improvement of arid grasslands.

23) A thorough investigation should be made of indigenous plants of arid and semiarid regions with a view toward determining their usefulness and adaptability to grazing and cultivation.

24) There is reason to believe that studies of pharmaceutical and industrial uses of desert plants would be justified.

25) Intensified studies should be made on the formation, measurement, and utilization of dew to determine its potentialities as a supplement to rainfall in arid regions. Such studies should encompass the utilization of dew by plants and the selection of plants most efficient in such use; the relationship of dew to soil moisture; and the establishment of physical relationships for extracting dew from the atmosphere.

26) Natural arid-land ecological communities of indigenous animals and plants in their original habitats are essential for educational and scientific purposes. Areas of adequate size should be acquired and preserved in the various arid-land countries.

Also see recommendations 1, 2, 3, 14, 16, 17, 18, and 30(i, ii).

Organization, Communication, and Interdisciplinary Programs

27) The UNESCO Advisory Committee on Arid Zone Research is urged to revise and reissue its list of national and international scientific institutions concerned with arid-land problems. The revised list should be as comprehensive and as up to date as possible and should include addresses and fields of interest in order to serve effectively for intercommunication among workers in various disciplines.

28) Permanent cooperation in connection with studies on the demineralization of salty and brackish water should be maintained among the UNESCO Advisory Committee on Arid Zone Research, the U.S. Saline Water Conversion Program, and Working Party No. 8 on demineralization of salt and brackish waters of the Organization for European Economic Cooperation (OEEC) with the objective of adapting technical possibilities to local needs and economic resources.

29) Interdisciplinary studies should be promoted in order to sharpen the concepts used in defining, delimiting, and classifying arid and semiarid lands, with special emphasis on the variability of precipitation.

30) A demand for the application of scientific and scholarly knowledge in arid areas should be created by means such as those indicated in items i–iv. It should be noted that in many situations the driving force necessary for getting available knowledge applied to improvement of land and water utilization is lacking. This driving force is essentially public demand or social pressure. Creating such demand is the most effective method of attaining the desired end. (i) Expansion of demonstration areas, even though they have some disadvantages. They stress management by practical operators, such as commercial or family farmers, where demonstrations of practical value are sought. However, demonstrations designed for the promotion of specific understanding of resource problems and techniques by business and political leaders, and even by technical men themselves, should be maintained. Cooperative interdisciplinary demonstrations on single resource-management problems are useful. They have been successfully extended to include treatment of the entire resource pattern in areas of some size. Complex demonstrations of integrated resource management on a scientific basis not only are proved but deserve more intensive use. Demonstrations may be supported entirely by public funds, partly by public funds, and entirely by private funds. The possibility of extending the usefulness of the demonstration technique under private auspices is a relatively new subject that deserves further attention. (ii) Research in the social sciences, exploring limiting factors that have tended to keep knowledge from application. Much more knowledge is needed concerning the social and economic factors that influence the development and application of science, and concerning the art of persuading people to take action in resource development to their own and their community's long-term benefit. Special attention should be paid to economic and social studies that can throw light on the relative values of competitive uses of water. However, the cooperation of engineering and natural sciences in such investigations will be essential, together with the collaboration of geographers and anthropologists. (iii) Enlistment of local leadership and local interests in support of both basic research and practical studies designed to advance present knowledge and to transfer such knowledge into a form for direct application. Local groups will profit by taking an active part in and by supporting these programs. In many fields in some parts of the world institutes have developed techniques for enlisting the aid of private industry in some broad public programs. These techniques may be applicable in areas other than the limited ones where they have been applied up to the present, but applications will vary with cultures and local conditions. (iv) Greater attention by scientists to their relations with the press, radio, television, and other channels of public information. Such relations involve an opportunity and a dual responsibility—responsibility to science for the presentation of an accurate and complete report and to the particular audience for framing scientific material in a form that will most effectively reach the public whose interest in resource development they hope to arouse and to inform. Also, more attention should be paid to the art of communication and its demands in the training of scientists.

31) More effective interdisciplinary pooling and dissemination of information should be developed for the purposes of advancing science, as well as public understanding of scientific matters, by the following. (i) Establishment of local and national committees on arid-zone problems to enlist public interest in support of studies of arid lands and the dissemination of information on results of such studies in each country. The nature of

such committees and their method of formation ought to be locally determined in order to meet special conditions in each country, but it is strongly urged that they be broad in scientific disciplines and in representation from both private and public agencies. These committees should operate in a manner best suited to the interests and possibilities of each country and should be aimed at encouraging research and spreading information, utilizing UNESCO as a clearinghouse in this field. (ii) Creation of a preliminary project to explore the feasibility of an abstracting service on arid-zone literature. A periodical, patterned after existing successful abstracting journals, would include, as soon after original publication as possible, abstracts of technical, economic, and social literature related to arid-zone problems and research. Consideration should be given to the desired business and production organization, the volume of material to be included, the subject-matter divisions, the availability of abstractors, the cost of publication, the required subscription price, and so forth. A target date for the report on this feasibility study should be 1 year from the adoption of this recommendation by some agency capable of committing funds. (iii) Encouragement of the formation of research organizations, comprehensive in discipline and concerned with the best use of specific limited resources. Such organizations should be encouraged in all arid lands through adequate and broadly based financial support and through organized community interest.

Also see recommendations 2, 3, 4, 5, 10, 13, 18, and 21.

Comments on these recommendations will be welcomed. They should be addressed to John A. Behnke, AAAS.

The Grand Theme of Stephen Polyak

Stephen Polyak, who died in his home in Chicago on 9 March, was one of the great neuroanatomists of our time, destined to outlive the brief span of his 65 years in monumental contributions to the knowledge of the visual pathways, particularly the retina. To the excellent appreciation by his colleague anatomists in the *Journal of Comparative Neurology*, some words by a physiologist can only add the perspective created by distance of approach to his research and emphasize its general significance.

Polyak contributed important papers to the histology of the brain, its afferent pathways as well as the cochleo-vestibular end organs, and was one of the foremost experts on the microscopic anatomy of the central nervous system. Like the greatest of his teachers, Ramón y Cajal, he became fascinated by the histology of the retina. But, whereas Cajal began with the retina, describing it in his autobiography as the oldest of his laboratory loves, and then proceeded to investigate the same types of cells in other parts of the central nervous system, Polyak's research went in the opposite direction, from the central nervous system down to its projections in the retina. Captivated by this, the noblest of our sense organs, he wrote: "The study of the retina, begun almost by accident, stimulated me to experiment with different methods and material, including human eyes, and led to my systematic reading of the literature pertaining to the anatomy of the eye and the physiology of vision. This, in turn, caused me to do more research and to conduct further experiments, until, submerged as I was in this work, I almost lost count of the years that seemed to be passing by like months, while the notes and the figures were accumulating into an ever-increasing pile. . . . Indeed, from a casual problem my program developed, in the course of a few years, into a grand theme—big enough to fill a lengthy life." It filled 30 years of his life, a period of increasing technical perfection, happy creation, and penetrating scholarship. It took him back again to the central projections of the visual pathways and culminated shortly before his death in a book of some 1600 pages on *The Vertebrate Visual System*, now being posthumously edited by H. Klüver of the University of Chicago.

Polyak, a Jugoslavian by birth, survived innumerable vicissitudes of World War I—imprisonment, fighting, disease—to find himself, a young physician interested in neurology, being taken care of by the Rockefeller Foundation as a research fellow studying in London with G. Elliot Smith (1924–25). In 1925 he worked in Madrid under Ramón y Cajal. His association with the University of Chicago began in 1926 in collaboration with C. Judson Herrick and K. S. Lashley. In the meantime his position at Zagreb was given to a colleague and so he returned to the United States, this time as assistant professor of neuroanatomy in response to an invitation by the University of California. In 1930 he went to the University of Chicago, serving in turn as assistant professor of neurology, associate professor of neurology (1932–37), and finally as professor of anatomy until his death. It is to the everlasting credit of this institution that it supported for a quarter-century not only Polyak's research but also the scholarly publications in which he synthesized the whole literature on the visual and other afferent pathways. The posthumous work, completed in a race with death, will contain approximately 10,000 references.

Attitude no less than achievement serves to characterize a scientist, and by both criteria Polyak ranked high. In the words quoted here he emerges, true to life, as a lone worker rather than as partner of a team or leader of research groups, a man intent on devoting his life to what he felt to be a "grand theme." Everything related to this theme had to be considered and penetrated. He became an unrivaled master of the Ehrlich technique and the Golgi silver chromate stain, an expert on the history of physiological optics, and a competent judge of present-day neurophysiological modes of approach to the subject of vision.

His book of 1941, *The Retina*, was immediately hailed as a classic. It gave the first complete description of the primate retina and was based on thorough research. Several new discoveries related to the synaptic organization of the retina, especially the amacrine and bipolar cells and the centrifugal pathways within the retina, were announced. He described the midget bipolars and, in this connection, the different mono- and polysynaptic organizations of cone and rod pathways and showed that the two types of receptor also have paths in common, as has since been amply borne out by physiological studies. For generations to come his work will be the leading source of reference for those interested in the way in which the retina collects and elaborates information for delivery to the higher centers.

The solitary worker may receive few honors—and Polyak had few if any—but may nevertheless by his attitude and achievements create values that the scientific world does well to remember.

RAGNAR GRANIT
Nobel Institute for Neurophysiology, Stockholm, Sweden

News of Science

New Affiliate of the AAAS

The American Physical Therapy Association has recently completed affiliation with the American Association for the Advancement of Science. The American Physical Therapy Association was founded in 1921 by a group of 220 World War I Reconstruction Aides as the American Women's Therapeutic Association. This name was changed to American Physiotherapy Association in 1922 and to American Physical Therapy Association in 1948. Even though the association was not founded until 1921, the profession had its beginnings more than 10 years prior to that date. Orthopedic surgeons particularly in Boston, New York, and Philadelphia, had selected graduates of schools of physical education and trained them in their offices and hospitals to take care of their patients. In 1916, when the catastrophic epidemic of poliomyelitis struck New York and New England, there was therefore a handful of individuals trained in muscle reeducation to treat the thousands paralyzed.

Physical therapy, although not designated by that name, had been established in England just prior to the turn of the century. Mary McMillan, who in 1921 became the first president of the association, received her training in England and in 1917 when World War I was declared was working in the office of E. G. Brackett, an orthopedic surgeon in Boston. She responded to an urgent telegram from Surgeon General Gorgas and organized the first physical therapy course at Walter Reed Hospital, Washington, D.C. There was already one physical therapist in the Surgeon General's office, Marguerite Sanderson. It was soon apparent that this one school could not supply the number needed, and 14 additional courses were initiated in institutions throughout the country. During World War I there were 2000 Reconstruction Aides trained and in service, with 300 serving overseas. The letters of commendation for the service given, if one did not read the dates and signatures, would be thought to have been written after World War II. General John J. Pershing wrote "The power of an army depends in a great measure upon the number of able bodied men returned to it from hospitals, which number is greatly enhanced by the proper treatment and correction or prevention of deformities resulting from injury." Secretary of War Newton D. Baker said "Your assistance to the orthopedic surgeons in helping them lay plans for the training of women to undertake the reconstruction of injured men in the hospitals; your management of their duties and your efforts to fit them into the military establishment all were to such good purpose that much pain was relieved and the number of hospital days for many men was lessened and the amount of their permanent disability was greatly reduced. This was a distinct contribution to the army and to the country. . . ." It was with this great heritage that the American Physical Therapy Association was founded and on which it has grown in numbers and in scope.

What happened to all the Reconstruction Aides, for there were only slightly more than 200 founding members? Civilian medicine was not ready to include them, and there were few employment opportunities, the reverse of which was true after World War II. Many married; others returned to their former jobs in physical education.

The profession of physical therapy grew steadily but slowly in the years between the two wars. The depression of the 1930's with its resulting low employment of all medical personnel did not materially affect physical therapy, since the numbers were still small. It was in this period, however, that an awareness of its potentials was growing. In 1941 when war was declared there were less than 1200 qualified physical therapists in the country. All efforts of the association were then channeled to meet the needs of the armed services. Emergency educational programs were initiated in seven Army hospitals, and all 15 civilian schools accelerated their courses. By 1945 the number of students enrolled was slightly more than 1000, almost equal to the entire number available in 1941. More than 1600 physical therapists served in the armed forces; 1532 were in the Army. This number was two-thirds of the association's membership in 1945. More than 800 saw overseas service.

The association, while directing every effort toward meeting the needs of the armed forces, recognized that civilian needs were not being fulfilled and that some thought must be given to preparing for a transition from a war-accelerated educational program to a peacetime one. Many schools thought there would be an oversupply of physical therapists and planned to reduce their capacity. It was soon apparent that there was no oversupply, in fact the shortage had begun.

During the past 10 years physical therapy has emerged as a science as well as an art. Physical therapy education has achieved academic recognition with a 4-year program leading to a baccalaureate degree. Programs leading to a master's degree have been established, and an increasing number of the profession have achieved their doctorate or are engaged in a doctoral program. Research in the sciences basic to physical therapy, such as anatomy and physiology, as well as research in the techniques of physical therapy, is attracting recruits.

In 1950 the association initiated a 3-year student-selection research program conducted by the New York University Testing and Advisement Center. Some of the long-range objectives of the program were designed (i) to provide matriculants of high calibre in physical therapy schools, (ii) to provide hospital departments and other installations with more effective physical therapy staff, (iii) to accord the field of physical therapy a higher professional status through the utilization of scientific selection and placement procedures similar to those currently in use for medicine, law, and other professions. Tests were administered to 1128 students beginning professional physical therapy study in 1950, 1951, and 1952. The report of the program was published in the *Physical Therapy Review* (Sept. and Oct. 1954).

In 1953 the association was asked by the Epidemiological Service of the U.S. Public Health Service to participate in a country-wide study of the efficacy of gamma globulin for household contacts of an acute polio patient. Two muscle evaluations of a household contact, diagnosed as polio, one at 7 to 10 days after onset and the second 50 to 70 days after onset were requested to assist in determining whether or not the patient had paralytic polio and the severity of paralysis. These tests proved to be of significant value in the study to the extent that in 1954 the association was asked by the National Foundation for Infantile Paralysis to select and train physical therapists to play a similar role in the now epochal Salk Vaccine Field Trials. Seventy-two physical therapists were prepared to perform two muscle evaluations on children diagnosed as polio cases who had received the vaccine or who were in the control groups. It was not known to the examiner whether the child had received vaccine or placebo. These tests were given 10 to 15 days after onset and again in 50 to 70 days. Results were forwarded to Thomas Francis, Jr., director,

Poliomyelitis Evaluation Center, University of Michigan, for use in his evaluation study. Once again the muscle evaluation proved to be a significant factor in determining the number of cases, the degree and severity of paralytic polio cases in the study on which Francis established the effectiveness of the vaccine in the three types of polio. The foundation granted funds to the association to carry out its role in these two important research projects. It appears particularly fitting that the profession of physical therapy, which has been intimately concerned with the treatment of paralytic polio since 1911 when the muscle test was first developed, should play an important role in the field trials of a vaccine that gives every evidence of bringing about the control of this crippling disease.

The association now has 6780 members with chapters in the 48 states, District of Columbia, Puerto Rico, Alaska, and Hawaii. Its official publication, the *Physical Therapy Review*, has a circulation of 7000 with subscribers in 47 countries. It is a member of the National Health Council and maintains cooperative relationships through committees and consultants with the American Hospital Association, the American Medical Association, Women's Medical Specialist Corps U.S. Army, Veterans Administration, Office of Vocational Rehabilitation, Children's Bureau, American Registry of Physical Therapists, and such voluntary agencies as National Foundation for Infantile Paralysis, National Society for Crippled Children and Adults, United Cerebral Palsy, and National Rehabilitation Association.

Each year the association holds an annual conference and also sponsors institutes and other study opportunities for its members. This year the American Hospital Association and the APTA conducted an Institute on Supervision and Administration, and an Institute on the Correlation of the Basic Sciences, Anatomy, Physiology, and Physics with Kinesiology was sponsored jointly with the Office of Vocational Rehabilitation.

The association is a founding member of the World Confederation for Physical Therapy and its executive director is the first president. The association will be host to the second congress of the World Confederation for Physical Therapy in June 1956.

The profession of physical therapy is still growing. The awareness of the Government and people of the United States of the importance of rehabilitating its handicapped citizens, young and old, rich and poor, has set new goals and challenges for the profession in meeting the needs of the people qualitatively and quantitatively. These challenges are accepted with confidence based on the history of the association. The members today, like those in the past, are, through continued study, basic and clinical research, ever seeking and putting into practice, under the direction of the physician and in cooperation with coworkers in other professions, methods of treatment that will prevent disability and hasten maximum recovery of our handicapped citizens.

MILDRED ELSON, *Executive Director*
1790 Broadway, New York, N.Y.

Soviet Invitation

On 13 June the following telegram was received by Detlev W. Bronk, president of the U.S. National Academy of Sciences, from the Academy of Sciences of the U.S.S.R.: "USSR Academy of Sciences holds its session on peaceful uses of atomic energy in Moscow 1–5 July 1955. Presidium of academy will be glad if National Academy of Sciences deems it possible to send three of their scientists working in that field to this session as our two weeks guests. All expenses connected with their stay here including those of travel throughout USSR will be paid by academy."

Bronk's reply to Academician Nesmeyanov, president of the U.S.S.R. Academy of Sciences, read: "Council of National Academy of Sciences appreciates invitation USSR Academy of Sciences to send three scientists to your session on peaceful uses of atomic energy in Moscow 1 to 5 July 1955. Shortness of time and preoccupation of qualified individuals with preparations for conference on same subject to be held in Geneva during August makes acceptance impossible. I am confident that Geneva conference will provide desired opportunity for exchange of information in this field."

International Observatory Program

Six observatories in as many countries began sharing observing time and taking part in the program of the Boyden Station in South Africa on 1 July, Donald H. Menzel, director of the Harvard College Observatory, has announced. In addition to Harvard Observatory, which established the original Boyden Station at Arequipa, Peru, in 1890, the observatories cooperating in this international program are Armagh, North Ireland; Dunsink, Eire; Hamburg-Bergedorf, Germany; Stockholm, Sweden; and Uccle, Belgium. The agreement among them was worked out at a meeting in Hamburg last summer.

The agreement followed a decision made in January 1953 by the administration of Harvard University to the effect that it could no longer support the observatory in South Africa. Harvard provided funds for the intervening 2 years, however, while astronomers in several countries sought a plan for continued operation of the station, which is situated at one of the best observation points in the Southern Hemisphere. The agreement, Menzel noted, is of importance to observational astronomy, since there are relatively few large observatories in the Southern Hemisphere, and the loss of even one would be serious.

Under a 2-year interim agreement, which may later become permanent, the six cooperating observatories have set up a plan that permits joint management of the Boyden Station and provides for its operating cost. Scientific control of the station rests in an administrative council, composed of the directors of the six observatories. The directors, in addition to Menzel, are H. A. Bruck, Dunsink; Bertil Lindblad, Stockholm; P. Bourgeois, Royal Observatory, Belgium; Otto Heckmann, Hamburger Sternwarte and Eric Lindsay, Armagh.

In recent years, Hamburg and Stockholm observatories have both contributed much to the systematic classification of stellar spectra; Uccle has been a center for asteroid observation, while Armagh has been concerned with galactic research and Dunsink with photoelectric and spectrographic work. Use of the Boyden Station will permit further extension of these activities in the southern sky.

AAAS Committees and Representatives for 1955

(Numerals in parentheses indicate year of expiration of term.)

Standing Committees

Affiliation and Association: (1955) L. V. Domm, chairman, Loyola University, Chicago; (1956) Fernandus Payne, Indiana University; (1957) I. Melville Stein, Leeds and Northrup Company, Philadelphia; (1958) Howard A. Meyerhoff, Scientific Manpower Commission; (1959) Herbert Carter, University of Illinois; Dael Wolfle, *ex officio*

AAAS Meetings: Leonard Carmichael, Smithsonian Institution; Bernard D. Davis, New York University College of Medicine; John E. Ivey, Jr., Southern Regional Education Board, Atlanta; Harry C. Kelly, National Science Foundation; Howard M. Phillips, Emory University; Raymond L. Taylor, *ex officio*; Dael Wolfle, *ex officio*

Executive: Warren Weaver, *chairman*, Rockefeller Foundation; retiring president and chairman of the board of directors, AAAS; George W. Beadle, California Institute of Technology; president, AAAS; Paul B. Sears, Yale Universtiy;

president elect, AAAS; Wallace R. Brode, National Bureau of Standards; Paul E. Klopsteg, National Science Foundation; Dael Wolfle, AAAS

Investment and Finance: (1955) L. Clark Brown, Rohrbaugh and Company, Washington, D.C.; (1956) Sheldon B. Akers, *vice chairman,* Brookings Institution; (1957) F. P. H. Siddons, *chairman,* American Security and Trust Company, Washington, D.C.; (1958) Malvern F. Morse, American Security and Trust Company, Washington, D.C.; (1959) Wallace R. Brode, National Bureau of Standards; Paul A. Scherer, *ex officio;* Dael Wolfle, *ex officio*

Publications: (1955) E. U. Condon, consulting physicist, Berkeley, Calif.; (1956) Paul B. Sears, *chairman,* Yale University; (1957) Thomas Park, University of Chicago; (1958) Ralph R. Shaw, Rutgers University; (1959) Chauncey D. Leake, University of Texas, Medical Branch; Dael Wolfle, *ex officio*

Special Committees

AAAS-Anne Frankel Rosenthal Memorial Award for Cancer Research: Warren Weaver, *chairman,* Rockefeller Foundation; retiring president and chairman of the board of directors, AAAS; Jacob Furth, American Association for Cancer Research; G. Burroughs Mider, National Cancer Institute; Richard L. Rosenthal, Richard and Hinda Rosenthal Foundation; C. Chester Stock, Sloan-Kettering Institute for Cancer Research; Harry M. Weaver, American Cancer Society

Constitution, Bylaws, and General Operations: Wallace R. Brode, *chairman,* National Bureau of Standards; Roger Adams, University of Illinois; Meredith F. Burrill, U.S. Geological Survey; Clarence E. Davies, American Society of Mechanical Engineers; Milton O. Lee, Federation of Society for Experimental Biology; Howard A. Meyerhoff, *adviser,* Scientific Manpower Commission; Dael Wolfle, *adviser,* AAAS

Management and Business Operations: Mark Ingraham, *chairman,* University of Wisconsin; George J. Beal, Rockefeller Foundation (retired); F. P. H. Siddons, American Security and Trust Company, Washington, D.C.; Paul A. Scherer, *ex officio;* Dael Wolfle, *ex officio*

Membership Development: Ralph Gerard, *chairman,* University of Illinois, Chicago; Clarence E. Davies, American Society of Mechanical Engineers; Rensis Lickert, University of Michigan; Dael Wolfle and all members of the AAAS staff as consultants

Research Grants, AAAS: Barry Commoner, *chairman,* Washington University; E. Lowell Kelly, University of Michigan; Hans Nussbaum, AAAS; Laurence H. Snyder, University of Oklahoma; H. Burr Steinbach, University of Minnesota; Dael Wolfle, *ex officio*

Retirement Plan (must be three staff members): Dael Wolfle, *chairman,* AAAS; Hans Nussbaum; Raymond L. Taylor

Socio-Psychological Prize Judging Committee: Leon Festinger, University of Minnesota; Theodore M. Newcomb, University of Michigan; Fred L. Strodtbeck, University of Chicago

Source Books in the History of Science: Gregory D. Walcott, *chairman,* Long Island University; Harlow Shapley, Harvard University; Edmund W. Sinnott, Yale University; Dael Wolfle, *ex officio*

Theobald Smith Award Judging Committee: S. E. Luria, University of Illinois, chairman of Section N, *ex officio, chairman*; Allan D. Bass, Vanderbilt University, secretary of Section N, *ex officio, secretary;* R. J. Dubos, Harvard Medical School and Rockefeller Institute for Medical Research; Chester S. Keefer, Robert Dawson Evans Memorial Hospital, Boston, Mass.; Karl Mason, University of Rochester School of Medicine and Dentistry; Severo Ochoa, New York University College of Medicine

Committees To Be Appointed

Newcomb Cleveland Prize
Resolutions

Representatives

Representatives on American Council on Education: Mark Ingraham, University of Wisconsin; Laurence H. Snyder, University of Oklahoma

Representative of Board of Directors on Cooperative Committee on the Teaching of Science and Mathematics: Harold Schilling, Pennsylvania State University

Representatives on Board of Trustees of Science Service: (1956) Kirtley Mather, Harvard University; (1957) Paul B. Sears, Yale University; (1958) Karl Lark-Horovitz, Purdue University

Representative on Council of National Organizations of the Adult Education Association of the United States: John A. Behnke, AAAS

Representative on Council of Old World Archaeology: Richard K. Beardsley, University of Michigan

Representative on Committee on the Kimber Genetics Award of the National Academy of Sciences: I. Michael Lerner, University of California, Berkeley

Representative on National Citizens Committee for Educational Television Advisory Committee: John A. Behnke, AAAS

Representative on National Committee for UNESCO: Elvin C. Stakman, University of Minnesota, St. Paul

Representative on National Conference on FAO: Noble Clark, University of Wisconsin, Agricultural Experiment Station

Representatives on Scientific Manpower Commission: Detlev W. Bronk, Rockefeller Institute for Medical Research; Dael Wolfle, AAAS

Representative on U.S. Committee on ISO Technical Committee 37—Terminology: Duane Roller, Ramo-Wooldridge Corporation, Los Angeles

Representatives on World Federation of Associations for the Advancement of Science: Kirtley Mather, *chairman,* Harvard University; Detlev W. Bronk, Rockefeller Institute for Medical Research; Karl Lark-Horovitz, Purdue University; Dael Wolfle, *ex officio*

Drug Addiction

On 7 June the committee on public health of the New York Academy of Medicine issued a *Report on Drug Addiction.* The 33-page document gives a brief review of laws and administration, an assessment of the existing situation, a review and criticism of Sen. Frederick G. Payne's bill on narcotic drug control, and concludes with an exposition of the academy's six-point program. This program outlines the following objectives:

1) A change in attitude toward the addict who is to be looked on as "a sick person, not a criminal."

2) To "take the profit out of the illicit drug traffic." The formation of new addicts is principally the result of commercial exploitation. If all profit were removed from dealings in narcotic drugs, there would be no incentive to give away the drugs in an attempt to addict others. The addict should be able to obtain his drugs at low cost under Federal control, in conjunction with efforts to have him undergo withdrawal. Under this plan, these addicts, as sick persons, would apply for medical care and supervision.

3) Medical supervision of existing addicts, with vigorous efforts toward their rehabilitation.

4) No relaxation in the efforts toward complete and permanent elimination of the supply of illegal narcotic drugs; provisions for suppression of illegal traffic should be retained.

5) To encourage an educational program for adults as well as for adolescents. Combined with the medical care of narcotic addicts and severe penalties for trafficking in drugs, there should be an adequate program of education for adults, teachers, and youth. By means of all educational mediums, including radio, television, the public press, forum, lecture, books, and pamphlets, there should be a concerted effort toward informing the public of the dangers of narcotic drugs. Furthermore, the need for treating addicts, for apprehending

illicit drug dealers, and for avoiding the use of narcotic drugs except under medical supervision should be impressed upon the population.

6) To study the epidemiology of drug addiction and to acquire information about the magnitude and pathogenesis of the disease. By means of the records accumulated at the central agency, it would be possible to have at all times an accurate count of the known resistant addicts in the country. It would also be possible to know how many addicts were undergoing treatment for their illness and how many relapsed after a period of abstinence. Data on the length of abstinence from narcotic drugs and therefore on the success of various types of treatment would be obtainable. On the basis of such information, research could be focused more readily on the "why" of addiction and on improved methods of treatment. There seems little possibility of learning the "why" of addiction until narcotic addicts can be studied under conditions that more nearly approximate normal existence than do the conditions of a hospital, however excellent the hospital may be.

The report was prepared by the following committee: Hubert S. Howe (chairman), Harry D. Kruse (secretary), Linn J. Boyd, McKeen Cattell, Milton J. Goodfriend, Arthur Vose Greeley, Lawrence C. Kolb, Asa L. Lincoln, Bernard J. Pisani, Dickinson W. Richards, and Conrad M. Riley, members.

New AAAS Chapter

A Carolina chapter of the AAAS is in process of organization. Officers elected by the founding group include L. D. Herring, Raleigh, N.C., acting president, and A. Edward A. Hudson, Edgewood Apartments, Goldsboro, N.C., acting secretary-treasurer. Any member of the association is eligible to join the chapter, the annual dues of which were fixed at $1.

The primary objective of the new group is to inform the lay public of the latest developments in science and to stimulate an interest in science as a career among high-school and junior-college students. The chapter plans self-supporting lectures to achieve these purposes. All interested persons are asked to communicate with Hudson.

■ Ambassador Lodge's proposal on 21 June that the United Nations receive and assemble data on the effects of radiation on human health and safety received enthusiastic welcome from the executive committee of the Federation of American Scientists. The FAS, under the chairmanship of Donald J. Hughes, senior physicist at Brookhaven National Laboratory, Upton, N.Y., expressed "hope that United Nations action in studying information on radiation effects may prove to be as successful an example of international cooperation as the atoms-for-peace program proposed in December 1953 by President Eisenhower."

The FAS officers noted that Sen. Payne and Rep. O'Hara had introduced resolutions in Congress calling for a UN study of radiation effects; they called upon Congress "for prompt and favorable action on these resolutions." On 14 Apr., the federation's executive committee had endorsed the Payne resolution and welcomed "the plan announced on April 8 by the National Academy of Sciences to appraise radiation effects. The Academy's study will provide a reliable technical evaluation of these effects," the earlier FAS statement said, and continued: "Worldwide acceptance of such a technical evaluation will be needed to bring international understanding, agreement and prophylactic action on the matter. Such a worldwide acceptance is most likely to be accorded the findings of a UN commission as proposed by the Federation (on March 6) and by Senator Payne (on April 13)."

■ The Los Alamos Scientific Laboratory, which is operated by the University of California for the Atomic Energy Commission, will hold an open house for families of employees and residents of Los Alamos 16–17 July to mark the 10th anniversary of the first nuclear detonation at Trinity site, near Alamogordo, N.M. This will be the first time since the laboratory was activated in 1943 that the technical area has been generally opened to news correspondents.

Scientists in the News

ROGERS MCVAUGH, professor of botany at the University of Michigan and curator of phanerogams in the university herbarium, has been granted a year's leave of absence, effective 1 Sept., to serve as program director in systematic biology for the National Science Foundation, Washington, D.C.

SYDNEY CHAPMAN, English geophysicist, emeritus professor at Oxford University, and professor at the University of Alaska, arrived in Boulder, Colo., last month to begin a year's appointment at the University of Colorado's High Altitude Observatory. During his stay he will participate in the joint research program that is being conducted by the observatory and the National Bureau of Standards.

Chapman will be away during part of this month and next to attend the International Astronomical Union meetings in Dublin, Ireland, and to carry out responsibilities in connection with his position as president of the International Committee for the International Geophysical Year. He will also leave Boulder in January 1956 to spend about 4 mo in College, Alaska. He will then return to Boulder for a number of months to complete his work there.

ROMAN SMOLUCHOWSKI, professor of physics and metallurgical engineering at Carnegie Institute of Technology, will spend the next academic year at the University of Paris as visiting professor of physics. He will give a course on solid-state physics at the Sorbonne and conduct research at the Ecole Normale Superieure.

ROBERT V. BROWN, associate professor of pharmacology at the University of Tennessee Medical Units since 1946, has resigned, effective 1 Sept., to join the staff of the pharmacology branch of the Army Chemical Center in Maryland.

Seven U.S. Department of Agriculture scientists who participated in the successful eradiction of the screw-worm fly from the island of Curaçao have been publicly commended for their work by the governor of the Netherlands Antilles. Documents signed by Governor A. A. M. STRUYCKEN have been received by B. T. SHAW, administrator, Agricultural Research Service, and six members of the Insects Affecting Man and Animals Section: A. W. LINDQUIST (head), A. H. BAUMHOVER, W. E. NEW, A. J. GRAHAM, D. E. HOPKINS, and F. H. DUDLEY.

The USDA's Entomology Research Branch, in cooperation with Curaçao authorities, succeeded in eradicating the livestock pest by releasing male insects that had been sterilized by exposure to radioactive cobalt.

It is felt that the success of the program has opened the way for a similar campaign against the screw-worm fly in the southeastern United States. However, there seems to be little hope of using this method against the screw-worm infestation that moves north from southern Texas each spring, for reinfestation from Mexico cannot be prevented. However, Texas screw-worms are not expected to reinfest the Southeast if precautions are exercised in shipping infested animals.

A report of the work on Curaçao will appear in a forthcoming issue of *Science*.

ROBERT D. ENGLERT, who has been associated with Stanford Research Institute since 1949, has been appointed manager of S.R.I.'s Pasadena laboratory. This appointment coincides with plans to extend project work of the laboratory into the fields of chemistry and chemi-

cal engineering. Under Englert's supervision facilities will be expanded and technical staff increased. The laboratory will continue its major work in air research, which was started in 1947.

Englert has conducted research in the utilization of inedible tallow, developing a process whereby the tallow is oxidized to dibasic acids. He has followed this work by studying products of the nitric acid process as intermediates in plasticizers and lubricants. In addition, he has developed herbicides designed to clear undesirable brush from grazing lands.

LESTER M. FIELD has been appointed head of the electron tube laboratory at the Hughes Aircraft Co., Culver City, Calif. He acquired his background in tube research and development at Bell Telephone Laboratories. Subsequently he was head of tube research projects at both Stanford University and California Institute of Technology. He will continue to be associated with the faculty at California Institute of Technology.

HOWARD W. POTTER has been appointed dean of the State University of New York College of Medicine in Brooklyn. Chairman of the college's department of psychiatry and acting dean since last September, Potter has been a member of the faculty for 15 years.

JOHN C. FORBES, research professor of biochemistry at the Medical College of Virginia, and FRANKLIN D. KIZER, chairman of the science department of Norview High School, Norfolk, have received the 1955 Distinguished Service awards of the Virginia Section of the American Chemical Society.

LEVON D. BECHTOL, formerly of the Baxter Laboratories, Morton Grove, Ill., has been appointed medical director and associate research director of Ethicon, Inc., manufacturer of surgical sutures, New Brunswick, N.J.

JOHN G. BIERI, formerly an associate professor in the department of biochemistry and nutrition, University of Texas Medical Branch, Galveston, has joined the nutrition unit of the National Institute of Arthritis and Metabolic Diseases, Bethesda, Md.

RALPH M. BERRY, formerly of the U.S. Coast and Geodetic Survey, Washington, D.C., has been appointed professor of geodesy and surveying at the University of Michigan. Another new appointment at Michigan is that of ERNEST FRANK MASUR, associate professor of civil engineering at Illinois Institute of Technology. He has been named associate professor of engineering mechanics.

EUGENE ALLEN, senior research chemist at the Bound Brook Research Laboratories of American Cyanamid Co., has been named editor of the Inter-Society Color Council *News Letter*. His predecessor was I. H. GODLOVE, editor from 1937 until his death last August. The Inter-Society Color Council is an organization that coordinates the work in color that is being done by its 23 member-bodies and various working committees.

LESTER O. KRAMPITZ, professor of microbiology and director of the department of microbiology at Western Reserve University medical school, has been granted a Fulbright award to teach and conduct research with Feodor Lynen in Munich, Germany, for the next academic year. He will sail on 13 July, going first to Brussels to attend the 3rd International Congress of Biochemistry.

The following are among those who have recently received honorary doctoral degrees.

University of Vermont and State Agricultural College: ALAN T. WATERMAN, director of the National Science Foundation.

University of Münster, Westphalia, Germany: GEORG VON BÉKÉSY, Psycho-Acoustic Laboratory, Harvard University.

University of Michigan: E. K. JANAKI AMMAL, director, Central Botanical Laboratory, Botanical Survey of India, Lucknow.

North Dakota State College: NEWELL P. BECKWITH, vice president and general manager, Rinshed-Mason Paint Co. of Canada, and vice president and technical director of its United States branch; WILLIAM F. SUDRO, former dean of the School of Pharmacy, N.D.S.C.

University of Pennsylvania: FRANKLIN DAVID MURPHY, chancellor of the University of Kansas; KARL S. LASHLEY, director, Yerkes Laboratories of Primate Biology, Harvard University; WILLIAM B. SHOCKLEY, research director, Weapons System Evaluation Group, Department of Defense, and director of transistor physics research, Bell Telephone Laboratories.

University of Stockholm, Sweden: WALLACE D. ARMSTRONG, head of the department of physiological chemistry, Medical School, University of Minnesota.

Bucknell University: JOHN S. BURLEW, assistant director, Franklin Institute of the State of Pennsylvania.

Kenyon College: GEORGE W. BEADLE, chairman of the division of biology, California Institute of Technology, and president of the AAAS.

Union College: CARYL P. HASKINS, president-elect of the Carnegie Institution of Washington and the Haskins Laboratories, Inc.; ROBERT LEBARON, former assistant to the Secretary of Defense for atomic energy.

Alfred University: W. H. SEBRELL, JR., director, National Institutes of Health.

Massachusetts College of Pharmacy: JOHN T. MURPHY, chief pharmacist of Massachusetts General Hospital and consultant to the Gray Pharmaceutical Co., Inc.

Necrology

IVERS SHEPARD ADAMS, 81, authority on salmon and waterfowl, Hardwick, Mass., 11 June; GEORGE H. ALEXANDER, 53, psychoanalyst, former director of Butler Hospital, Providence, R.I., 29 Apr.; HARVEY S. ALLEN, 48, professor of surgery at Northwestern Medical School and attending surgeon at Passavant and County Hospitals, Chicago, 30 May; LEOPOLD ARZT, head of the Dermatologic Institute at the Vienna University Clinic, Vienna, Austria, 21 May.

ROBERT W. BOYLE, 71, former professor of physics and dean at the University of Alberta, former director of the division of physics and electrical engineering for the National Research Council of Canada, London, England, 18 April; JOHN L. BUYS, 58, professor of biology and chairman of the department at St. Lawrence University, Canton, N.Y., 24 May.

AARON S. CANTOR, 70, cardiologist, Scranton, Pa., 18 Apr.; JOHN D. CLAIR, Sr., 67, civil engineer with Nicholson Co. of New York, Hohokus, N. J., 23 Apr.; D. DALE CONDIT, 69, geologist, retired from Standard-Vacuum Oil Co. of New York, Stamford, Conn., 6 May.

WALTER F. DEARBORN, 76, pioneer in educational psychology and emeritus professor of education at Harvard University, St. Petersburg, Fla., 21 June.

CLARENCE LEE FURROW, 58, professor of biology at Knox College, Galesburg, Ill., 9 Mar.

EDWARD J. HEALEY, 53, chemical engineer, productions manager of Fiske Brothers Refining Co. of Newark, N.J., Elizabeth, N. J., 13 June; PHILIP E. HENDERSON, 53, head of the department of economics and business at Wilmington College, former president of Western College of Women, Wilmington, Ohio, 26 Apr.; LIEBMAN HERSH, 73, professor of demography and statistics at the University of Geneva, Geneva, Switzerland, 9 June.

RICHARD JAHIEL, 56, physician and research gastroenterologist and immunologist, New York, 31 May; HILTON IRA JONES, 72, research chemist, former professor of chemistry at Dakota Wesleyan University and Oklahoma Agricultural and Mechanical College, Wilmette, Ill., 2 May.

JULIUS I. KLEPPER, 74, former clinical

professor of otolaryngology at the New York Polyclinic Medical School and Hospital, author, New York, 15 June.

PHILIP LADIN, 46, surgeon, teacher of surgery at New York Polyclinic Medical School and at New York Medical College's Flower and Fifth Avenue Hospitals, New York, 27 Apr.; BASILLA B. LIPETZ, associate professor at Albany Medical College and attending psychiatrist at Albany Hospital, Albany, N.Y., 26 May; OSWALD S. LOWSLEY, 70, pioneer urological surgeon and former director of the department of urology, James Buchanan Brady Foundation, at New York Hospital, New York, Stamford, Conn., 3 June.

RODERICK PEATTIE, 63, professor of geography at Ohio State University, author, Columbus, Ohio, 18 June.

JOSEPH L. ROOT 3RD, former clinical professor of osteopathy and clinical director at the Philadelphia College of Osteopathy, Santa Ana, Calif., 13 June.

GEORGE F. SHIRRAS, 69, former professor of economics at Gujarat College and the University of Bombay, former director of statistics for the government of India, Aberdeen, Scotland, 23 June; ALEXANDER SINCLAIR, specialist in thyroid surgery, Sault Ste. Marie, Ont., Canada, 29 May; WALDO E. STEIDTMANN, 59, chairman of the department of biology at Bowling Green State University, Toledo, Ohio, 23 June; JAMES STOLLER, 97, retired professor of geology at Union College in Schenectady, N.Y., Bamberg, S.C., 5 June. FRANK TRITSCHLER, 56, chemist with Merck & Co., Union, N.J., 15 June; RUFUS E. ZIMMERMAN, 68, physical chemist, former vice president of research and technology and retired chairman of the research policy committee of the United States Steel Corp., Summit, N. J., 21 June.

Education

■ The National Agricultural Extension Center for Advanced Study, supported initially by a W. K. Kellogg Foundation grant of $1,239,000, will be established at the University of Wisconsin College of Agriculture. The foundation funds will be used from 1955 to 1961 for advanced training in agricultural extension education. The opening of the center is scheduled for September.

The center is expected to be concerned with four problem areas: (i) an effective, more standardized program of extension personnel training and management; (ii) a more systematic, dynamic approach to the problem of extension program planning, execution, and evaluation; (iii) the improvement of organizational relationships of extension services, both external and internal; (iv) the lack of a complete up-to-date evaluation and assessment of the functions and responsibilities of the Cooperative Extension Service.

Initial efforts of the center, the proposal indicates, will be in personnel training and management, extension program planning, and in organizational relationships. There will be academic training, short courses, workshops, conferences, and research at the center itself; pilot studies and demonstrations elsewhere; and a system developed for making the findings of the center available throughout the agricultural extension field. Center personnel will include a director and three associates, several staff members and secretarial assistants.

The plan of Kellogg Foundation support calls for declining aid through seven years until the cooperating institutions take over full support in the eighth year. Cooperating in the project, in addition to the Kellogg Foundation and the University of Wisconsin, are the Land-Grant Association, the 51 Extension Services throughout the country, and the Federal Extension office.

■ Ohio State University is offering a new degree, a bachelor of science in physical therapy.

■ The Army Medical Service is conducting its postgraduate course on the medical care of atomic casualties at Walter Reed Army Medical Center, Washington, six times in the fiscal year that began 1 July instead of the four times such classes have been held in previous years.

This is being done to meet the greatly increased demand from civilian physicians throughout the country for admission to the sessions. The past year marked the first time representatives of the American Medical Association, the medical schools, and allied health agencies were admitted to the course, which is given in the Army Medical Service Graduate School.

Since a strict quota is maintained under an allotment system, applications for attendance from physicians or other qualified professional personnel must be made through their respective affiliations. In addition to the American Medical Association and the professional schools, these affiliations include the U.S. Public Health Service, the Federal Civil Defense Administration, the Veterans Administration, and the Armed Forces medical services. Reserve medical officers may apply through the chief of their military district to the Commanding General of the appropriate Army area.

Applicants are required to file their requests four weeks in advance of the course date desired. Dates for the six courses of the year are 11–16 July (enrollment completed); 12–21 Sept.; 5–14 Dec.; 30 Jan.–8 Feb.; 19–28 Mar.; and 4–13 June. Lodging and travel expenses for those attending the course are borne by the individual or the organization he may represent. Clearance for contact with atomic energy information is unnecessary, for the course membership is entirely professional and the material used is unclassified.

■ Approval of a Ph.D. program in psychology at Wayne University has recently been announced by C. M. Louttit, chairman of the university's psychology department. The psychology program will begin next September with limited enrollment. There are at present 29 programs leading to a doctorate at the university.

Grants, Fellowships, and Awards

■ The Theobald Smith award of $1000 and a bronze medal, which has been given 10 times since 1937 by Eli Lilly and Co., of Indianapolis, Ind., under the auspices of the AAAS, will be presented during the association's 122nd meeting, to be held in Atlanta, Ga., 26–31 Dec.

Nominations are now being requested for the award. They must be made by fellows of the AAAS and should be sent to the secretary of the section on medical sciences, Allan D. Bass, Department of Pharmacology, Vanderbilt University School of Medicine, Nashville 5, Tenn. Nominations should be accompanied by full information concerning the nominee's personality, training, and research work.

The prize is given for "demonstrated research in the field of the medical sciences, taking into consideration independence of thought and originality." Any United States citizen who was less than 35 years of age on 1 Jan. 1955 is eligible. The research is not to be judged in comparison with the work of more mature and experienced investigators.

Nominations must be received *before 1 Sept.* The secretary requests that six copies of all data be submitted. The vice president of Section N of the Association and four fellows will form the committee of award.

■ According to the results of the Institute of International Education's survey, 5036 foreign physicians from 84 countries are training in American hospitals as interns or residents. The physicians surveyed for this report are all training in hospitals approved by the American Medical Association, and intend to return to their home countries after completion of training.

More than one-fourth of the visiting doctors come from Far Eastern countries; Latin Americans, and Europeans each represent one-fourth of the total. Citizens of 10 countries make up two-thirds of the total: the Philippines, China, India, and

Korea in Asia; Turkey in the Near East; Germany and Italy in Europe; Mexico, Cuba, and Canada in the Western Hemisphere. The most frequently mentioned specialties are general surgery and general medicine.

Twelve percent of the foreign physicians are women, a higher ratio than that of women to men physicians in the United States. Of the foreign doctors here, Asian nationals include the highest percentage (21 percent) of women.

■ Nearly $350,000 will be made available to 39 institutions of higher education in 1955 by Shell Companies Foundation, Inc. The foundation administers donations made by Shell Oil Co. and its subsidiaries for the support of education and various philanthropies. Shell has provided $1,500,000 for 407 fellowships and 89 research grants since the program was started in 1947.

The foundation's 1955 program again emphasizes the training of scientists and the development of advanced scientific and allied knowledge. However, a large part of the funds will go to the recipient institutions for their unrestricted use. The funds designated directly for fellowships and research grants in a science or other field will be assigned and administered by the schools within those broad fields.

Under the program, 49 fellowships will be made available to 36 institutions for postgraduate education. They will support studies in the following fields: business administration, chemical engineering, chemistry, geological engineering, geology, geophysics, mechanical engineering, non-nuclear physics, petroleum production engineering, and plant science.

Each fellowship will provide a fixed stipend of $1500 to the student (who will be selected by the school), pay tuition and fees, provide cost of education supplements up to $500 to the institution, and, in schools not supported by taxes, provide an additional supplemental grant of $500. In aggregate, the 49 fellowships will have a value of $125,000.

The fellowships will be awarded, when practicable, to students nearing completion of their postgraduate work who plan to practice their professions in the United States. No obligations concerning future employment will exist for either Shell or fellows.

A larger part of the fund will go for 20 research grants to 15 institutions. The nine designated fields are chemistry, chemical engineering, engineering mechanics, geology, geophysical engineering, mathematics, mechanical engineering, metallurgy-corrosion, and physics.

In the case of each grant, Shell will provide a basic fund of $5000 for a study chosen by the school and a supplemental grant of $2500. The extra donation may be applied by the school to any campus expense—whether the need is for salaries, equipment, plant or any other —and it need not relate to the research project. The institutions will be requested to give the foundation a report on the use of the funds. The total value of these 20 research grants is $150,000.

In addition, the foundation's higher education funds will provide contributions to plant and capital funds of selected institutions and to national educational groups. These include the National Fund for Medical Research, the National Science Teachers Association, and the United Negro College Fund.

■ The Association of Universities of the British Commonwealth has published a pamphlet, United Kingdom Postgraduate Awards, listing postgraduate and research awards at Commonwealth universities tenable by students from overseas. It also lists some of the more important awards available overseas to United Kingdom graduates. The pamphlet is designed as an appendix to the *Commonwealth Universities Yearbook 1955*, which was published in May. For copies, write to the association, 36 Gordon Square, London, W.C. 1.

■ In appreciation of the successful 10-year program of the National Sanitation Foundation, Ann Arbor, Mich., in bringing representatives of official health agencies together with members of its industry to improve sanitation for the benefit of all, the Food Service Equipment Industry, at its annual meeting in May at Chicago, presented a special award of merit to the foundation. Walter F. Snyder, N.S.F. executive director, accepted the award for the foundation.

■ The American Cyanamid Co. has announced that 17 undergraduate scholarships and 14 graduate fellowships will be awarded in chemistry and chemical engineering for the academic year 1955–56. Under the company's undergraduate scholarship program, now in its second year, junior or senior students selected by their university or college authorities will receive $600 each for the academic year, while the school will receive $300 for the unrestricted use of its chemistry or chemical engineering department.

Under the fellowship program, Cyanamid will award $1500 plus full tuition and laboratory fees to graduate students in their final predoctoral year. Their school's chemistry or chemical engineering department will receive $300 for unrestricted use.

In addition to the foregoing, Cyanamid's aid-to-education program is currently providing funds in excess of $600,000 annually in the form of grants-in-aid, scholarships, and fellowships at various colleges and universities, medical faculty awards, and direct contributions to the United Negro College Fund and the funds of other educational institutions.

Miscellaneous

■ The following chemicals are wanted by the Registry of Rare Chemicals, Armour Research Foundation of Illinois Institute of Technology, 35 W. 33 St., Chicago 16, Ill.: chlorotris(*P*-nitrophenyl)methane; 3,4-dimethoxybenzoic acid; borazole; copper 2,4-dichlorobenzoate; 2,3-dimethylsuccinic acid (D or L); mesobilirubinogen; *N*-methyl isoindole; anatabine; *N*-methyl anatabine; magnesium lauryl silicate; urushiol; 2,6-dimethylol-1,4-dioxane; quinuclidine; solanidine; 1-threonic acid; nitronium fluorosulfonate; β-carboxyadipic acid; 7-nitrohydrindene; 2-aminocyclopentene-1; and *N*-(diethylaminoethyl)-*N'*-nitrosourea.

■ Muscular Dystrophy Associations of America, Inc., 39 Broadway, New York 6, is distributing to physicians, research workers, medical publications, and libraries the proceedings of its Third Medical Conference held in New York City last October. Attended by more than 400 doctors, scientists, and laymen, the conference was the largest seminar on muscular dystrophy ever held. The proceedings were published by the *American Journal of Physical Medicine*.

Among the leaders of the symposiums were Arthur S. Abramson of New York Medical College; D. Denny-Brown of Harvard University Medical School; Herbert S. Gasser of the Rockefeller Institute for Medical Research; Ralph W. Gerard of the University of Illinois; and John B. Griggs of Newington Hospital, Newington, Conn.

■ The multiplicity of medical journals, in a multiplicity of languages, has tended to prevent the easy dissemination of medical knowledge. Therefore, the German journal *Deutsche medizinische Wochenschrift* is now printing English and Spanish summaries of the original articles published in each issue. It is hoped that this will stimulate, among physicians in other countries who know little German, a livelier exchange of medical information with their German colleagues. For information, write to Dr. Walter Von Brunn, Herdweg 63, (14a) Stuttgart, Germany.

Erratum: The first sentence of the news item, "cause of lung cancer" [121, 662 (6 May 1955)] is misleading because it does not state that the tests were carried out on mice. Kotin's actual words were: "Air pollutants synthetically reproduced in inhalation chambers resulted in a significantly greater yield of lung tumors in exposed mice when contrasted with those in pure air chambers."

Reports and Letters

Quantitative Analysis for Thorium by X-ray Fluorescence

Techniques are being developed by the U.S. Geological Survey for the quantitative analysis of rocks, minerals, and ores for thorium by fluorescent x-ray analysis. This work is part of a program that is being conducted on behalf of the Division of Raw Materials of the U.S. Atomic Energy Commission.

The method is a modification of the thorium method described by I. Adler and J. M. Axelrod [*Anal. Chemistry* **27,** 1002 (1955)]. It differs from their method in that (i) selenium is used instead of thallium as the internal standard and (ii) the samples are not briquetted.

The equipment consists of an unmodified Norelco x-ray spectrometer and plastic sample holders. These sample holders fit into the sample holder supplied by the manufacturer. In the top of the plastic blocks there is a rectangular recess 34 by 21 by 1 mm.

Standards are prepared by grinding together for ½ hr in an agate mortar 2 g of reagent-grade ThO_2 and a matrix of ground silica and Fe_2O_3, 3:1 by weight; 400 mg of silicon carbide No. 320; and 40 mg of 10-percent elemental selenium. The silicon carbide aids in the grinding process by further reducing the particle size of the other constituents. The powder is packed in the plastic sample holder. The sample is then inserted into the conventional Norelco x-ray spectrometer, and three positions are measured—$ThL\alpha_1$, $SeK\beta$, and a nearby convenient background position. This background position is determined by scanning over the spectrum region of the $ThL\alpha_1$ and $SeK\beta$ lines. The position is chosen by visual inspection of the graph. Using a LiF crystal, 29.5° was found to be a satisfactory background position in most cases.

The background is subtracted from the intensities of the $ThL\alpha_1$ and $SeK\beta$ lines. The ratio of the intensities of $ThL\alpha_1$ to $SeK\beta$, in counts per second, is plotted against a percentage of thorium (as the ordinate). The resulting curve is a straight line up to about 0.7 percent of thorium.

Above about 0.7 percent of thorium, the curve deviates from linearity because of coincidence losses in the counting circuits and poor resolution. This causes some $ThL\alpha_1$ radiation to be counted as $SeK\beta$. Coincidence losses can be overcome by the use of apertures to reduce the counting rate to about 500 counts/sec. Adler has shown that better resolution, but poorer sensitivity, can be obtained by using a quartz crystal instead of LiF.

Samples are prepared in much the same fashion. To a 2-g sample, 40 mg of 10-percent selenium in silica and 400 mg of SiC is added. This mixture is ground for ½ hr and is then measured in the same way as the standards. In each case, the background count is subtracted from the $ThL\alpha_1$ and $SeK\beta$ before computation.

The x-ray fluorescent analyses are compared with quantitative spectrographic analyses and with radiochemical analyses of the same samples in Table 1.

One sample was packed into the holder and counted ($ThL\alpha_1$) six times. This process was repeated six times, yielding 36 measurements. Variance was calculated on these replicate analyses. The actual quantity used was the time in seconds required to count 12,800 counts. The sample concentration was 0.215 percent of thorium. The standard deviation owing to packing, or more probably to sampling, was 0.72 sec. The error, or precision standard deviation, was 0.32 sec. The total time for 12,800 counts was about 40 sec. Sampling and packing doubled the error caused by recounting alone.

The error variance was calculated both on routine samples (ores) and on synthetic standards. Ores ranging from 0.4 to 0.8 percent of thorium had a standard deviation of 0.026 percent of thorium, based on 18° of freedom. Ores in the range of 0.01 to 0.05 percent of thorium had a standard deviation of 0.0026 percent of thorium based on 12° of freedom. Synthetic standards in the range of 0.1 to 0.3 percent of thorium had a standard deviation of 0.0042 percent of thorium based on 6° of freedom. In the range from 0.02 to 0.3 percent of thorium the standard deviation was 0.0026 percent thorium with 6° of freedom.

Table 1. Accuracy of fluorescent x-ray analysis for percentage of thorium

Sample	Quantitative spectrographic	Radiochemical	Synthetic spectrographic standard	Average of quantitative spectrographic and radiochemical	Fluorescent x-ray analysis
A, synthetic			0.10		0.10
B, synthetic			0.02		0.023
C, synthetic			0.032		0.037
D, synthetic			0.32		0.324
E, synthetic			0.75		0.71
F, ore	0.63	0.61		0.62	0.64
G, ore	0.49	0.47		0.48	0.48
H, ore	0.66	0.66		0.66	0.80
I, ore	0.34	0.38		0.36	0.43
J, ore	0.52	0.70		0.61	0.75
K, ore	0.43	0.51		0.47	0.57
L, ore	0.12			0.12	0.12
M, ore	0.17	0.17		0.17	0.18
N, ore	0.70	0.66		0.68	0.75
O, ore	0.48	0.49		0.485	0.48

ALAN G. KING
PAULINE DUNTON
U.S. Geological Survey,
Denver Federal Center, Colorado
27 April 1955

Pathways of Glucose Metabolism in Corneal Epithelium

It has been previously shown that in the corneal epithelium the direct oxidative pathway, or the hexose monophosphate shunt, is an alternate route for glucose metabolism (*1*). It appears that in ocular tissues, such as the corneal epithelium and especially in lens (*2*), the shunt mechanism accounts for most of the CO_2 produced from glucose. To approximate the significance of the alternate pathway in the corneal epithelium, a comparison was made of the incorporation of C^{14} from 1-C^{14} and 6-C^{14} glucose into CO_2 (*3, 4*) and lactic acid (*5*).

Table 1. Incorporation of glucose-C^{14} into $C^{14}O_2$ and C^{14}-lactic acid by corneal epithelium. The values are given as the mean ± the standard error in counts per minute, per gram of wet weight, per 3 hr. The specific activity of 1-C^{14} and 6-C^{14} glucose was 480 counts/min μmole.

Determinations		Total counts/min recovered		Ratio C-1/C-6
Compound	No.	1-C^{14} glucose	6-C^{14} glucose	
CO_2	12	3370 ± 68	507 ± 15	6.7
Lactic acid	6	5330 ± 221	8105 ± 204	0.65
Sum		8700	8612	

Bovine corneal epithelium (700 to 800 mg) was incubated for 3 hr at 37.5°C with 20 μmole/ml of glucose in 6.0 ml of Krebs-Ringer bicarbonate buffer equilibrated with a gas phase of 95-percent O_2 and 5-percent CO_2. At the end of the incubation period the reaction mixture, contained in an erlenmeyer flask equipped with a side arm and center well, was acidified, and the CO_2 released was absorbed by a sodium hydroxide solution injected into the center well.

Aliquots of the CO_2 recovered were analyzed for CO_2 content (*6*) and radioactivity. The radioactivity of CO_2 was counted as $BaCO_3$ with an end-window Geiger tube. The specific activity of 1-C^{14} and 6-C^{14} glucose was 480 counts/min μmole and was determined by the combustion method of Van Slyke and Folch (*7*). The amount of lactic acid recovered after incubation was measured by the method of Barker and Summerson (*8*). The specific activity of the lactate was determined after oxidation to acetaldehyde and was counted as the dimedon-acetaldehyde complex (*9*). To employ this method it was necessary to remove glucose from the reaction mixture. This was accomplished by deproteinizing the reaction mixture with 10-percent trichloroacetic acid.

The resulting supernatant, neutralized to *p*H 5 to 6, was then placed on a Dowex 1 (chloride) column 30 by 1.2 cm. The column was washed with 1 lit of water to remove all traces of the isotopic glucose. Upon subsequent elution with 0.01*N* HCl, the lactic acid was recovered within a 50-ml fraction, and without further treatment it was oxidized according to the method of Brin (*9*).

The reaction mixtures from two experiments were usually pooled to give a sufficient amount of lactate (60 μmole) for this determination. As a control of this method, nonradioactive lactate was separated from a simulated reaction mixture containing isotopic glucose, and no radioactivity was detectable when the recovered lactate was converted to the dimedon-acetaldehyde complex.

The results of the experiment when corneal epithelium was incubated with either of the two isotopic forms of glucose are shown in Table 1.

As is shown in Table 1, the ratio of $C^{14}O_2$ from 1-C^{14} glucose/6-C^{14} glucose of 6.7 indicates that there does occur a preferential cleavage of the C-1 of glucose in contrast to C-6. If glucose were metabolized via the glycolytic and citric acid pathways exclusively, a ratio of 1 would have been observed. It appears that the shunt mechanism is particularly active in the production of CO_2 in this tissue. That this is the case, even though most of the glucose is metabolized via the glycolytic scheme, suggests that the citric acid cycle is relatively inactive in this tissue.

From the amount of radioactivity incorporated into lactic acid, as shown in Table 1, it is apparent that there exists an active glycolytic pathway, and an approximation of the relative extent of this route and the shunt mechanism is possible. Since the C-1 of glucose is oxidized directly to carbon dioxide in the shunt mechanism, it would appear that the 5330 counts/min recovered in the lactate from 1-C^{14} glucose is derived solely by the glycolytic route. An identical amount of radioactivity in lactate must be furnished by glycolysis when 6-C^{14} glucose is the substrate, and the additional amount observed is that derived from the direct oxidative pathway. Therefore, the ratio of C^{14}-lactate from 1-C^{14} glucose/6-C^{14} glucose of 0.65 can be taken as the approximate fraction of glucose metabolized via the glycolytic pathway. It appears that about 65 percent of the glucose is metabolized via the conventional glycolytic scheme and 35 percent by the shunt mechanism.

It is of interest to note that the sum of radioactivity incorporated into carbon dioxide and lactic acid is identical from the two forms of labeled glucose. This indicates that in this tissue, the intermediates of the direct oxidative pathway do not accumulate to any appreciable extent. Furthermore, it must mean that the triose phosphates formed in the shunt mechanism are eventually converted to lactic acid.

In the corneal epithelium, even though most of the glucose is metabolized by the glycolytic pathway, the presence of the hexose monophosphate shunt is indicated because a preferential oxidation of the C-1 of glucose occurs. Moreover, since the citric acid cycle appears sluggish, the shunt mechanism probably plays a more conspicuous role in the production of biological energy in the cornea than it does in other mammalian tissues.

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References and Notes

1. J. H. Kinoshita and T. Masurat, *Arch. Biochem. and Biophys.* 53, 9 (1954).
2. J. H. Kinoshita, *Abstracts of 126th Meeting Am. Chem. Soc.* (1954).
3. B. Bloom and D. Stetten, *J. Am. Chem. Soc.* 75, 5446 (1953).
4. S. Abraham, P. F. Hirsch, I. L. Chaikoff, *J. Biol. Chem.* 211, 31 (1954).
5. This work was supported by the U.S. Atomic Energy Commission.
6. D. D. Van Slyke and J. M. Neill, *J. Biol. Chem.* 61, 523 (1924).
7. D. D. Van Slyke and J. Folch, *ibid.* 136, 509 (1940).
8. S. B. Barker and W. H. Summerson, *ibid.* 138, 535 (1941).
9. M. Brin and R. E. Olson, *ibid.* 199, 475 (1952).

8 April 1955

Acclimation of the Critical Thermal Maximum of the Reptile Urosaurus ornatus

Experiments were designed for preliminary investigation of acclimation of temperature tolerance in a reptile, the small lizard *Urosaurus ornatus linearis* Baird. The relatively small sample sizes ($N = 12$–15) have proved adequate. A total of 45 individuals was used, including young and adults in the body-weight range of 1.26 to 4.85 g. Measurements were restricted to those for the upper lethal temperature range.

In such investigation it is useful to explore two different but related expressions of temperature tolerance—that is, the critical thermal maximum, or incipient upper lethal temperature, and the resistance time. General methods currently used for determining such values for fishes were not employed (*1*). In the present work, the critical thermal maximum was first determined (= 43.1 ± 0.25°C); afterward the resistance time at 44.0°C was measured. Resistance time at a given constant temperature may be given as the arithmetic mean, or the geometric mean, survival time. The animals were tested singly in air in 100-ml-capacity glass tubes, immersed in an electrically heated and stirred water bath, with air supplied through coils of immersed copper tubing. In tests for the critical thermal maximum, the animals were started at 39°C and the temperature was raised 0.5°C every 30 min. The animal's body temperature reached the new environmental

temperature within 5 min of the change of bath temperature. Fresh animals from the field (field controls) were maintained 1 to 2 days at room temperature (22° to 26°C) prior to testing. Experimental animals were kept at the constant temperature of 35°C for 7 to 9 days (the acclimation period used) prior to testing. All lizards were collected in Sabino Canyon, near Tucson, Ariz., during April and May.

The critical thermal point of locomotory disability in *U. ornatus* under such experimental conditions is readily observed, in order to allow a respectable degree of accuracy for determination of the critical thermal maximum for the individual. The concept of the critical maximum and critical minimum of Cowles and Bogert (*3*) for a population may be modified so that either measurement may be visualized as a value that is the arithmetic mean of the collective thermal points at which locomotory activity becomes disorganized and the animal loses its ability to escape from conditions that will promptly lead its death.

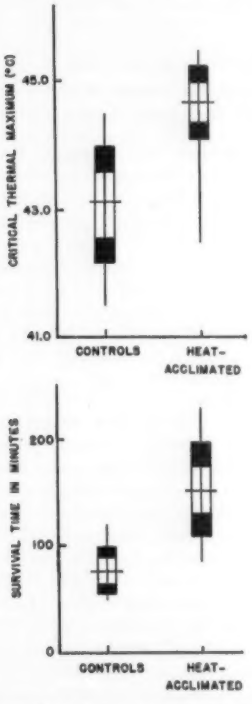

Fig. 1. Critical thermal maxima (°C) and resistance times (minutes) for the lizard *U. ornatus linearis* acclimated for 7 to 9 days at 35°C. The significant differences are shown graphically by the wide spread, without overlap, of the white rectangles, which represent values of two standard errors on each side of the mean. One black and one white rectangle combined, on each side of the mean, represents one standard deviation.

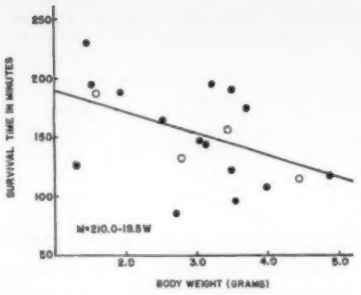

Fig. 2. Correlation of survival time with body weight for *U. ornatus linearis*. The four open circles represent the observations (black dots) grouped with class interval widths of 0.5 g, yielding a regression coefficient of $M = 215.7 - 22.6W$, which is not significantly different from the regression coefficient of the unclassed observations.

From the ecological and evolutionary point of view this *is* the lethal "point."

The means and their standard errors for the determinations of the critical thermal maximum in degrees centigrade, and their associated values of t and P, are as follows: Heat acclimated sample —44.5 ± 0.17; controls—43.1 ± 0.25; $t = 5.6$, $P < 0.001$ (Fig. 1).

The means, standard errors, t and P for the determinations of resistance time in minutes are as follows: Heat acclimated sample—152.8 ± 11.3; controls—76.4 ± 6.7; $t = 5.8$, $P < 0.001$ (Fig. 1).

The fact of a well-marked acclimation of the critical thermal maximum of *U. ornatus* is clearly established by both sets of data, which are graphed in Fig. 1. It may be seen that there is a direct, rather than an inverse, relationship between the direction of acclimation change and the acclimating temperature. The acclimating temperature used (35°C) is the mean of the normal activity range (eccritic mean) determined by us for the subspecies used (*3*).

Figure 2 depicts the inverse relationship between resistance time and body size (and age) for acclimated animals. The smaller (younger) individuals show greater resistance when subjected to relatively high environmental and body temperature. Moreover, under the experimental conditions employed, the small individual is at a given body temperature slightly longer than the larger individual, because of the more rapid heating of the smaller individual as a result of its greater surface-to-volume ratio.

The regression lines in Fig. 2 were fitted by the method of least squares. A hyperbolic curve has not been fitted, simply because of the scatter distribution of the small sample ($N = 15$). The correlation coefficient r is -0.474 for the individual ungrouped plots; the correlation is significant. For the same data (Fig. 2), when they are grouped with class interval widths of 0.5 g, r becomes -0.870, which is significant.

It has thus been demonstrated (i) that the critical thermal maximum of the lizard *U. ornatus* is significantly modified by acclimation to temperature, (ii) that the relationship between acclimation and acclimating temperatures is direct rather than inverse, and (iii) that the resistance to heat death is greater in the smaller, younger individuals.

After 7 to 9 days acclimation at a constant temperature of 35°C, the critical thermal maximum was increased by 1.4°C, and the resistance time at 44°C was approximately doubled.

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References and Notes

1. F. E. J. Fry, J. S. Hart, K. F. Walker, *Univ. Toronto Biol. Series*, No. 54, 10 (1946); J. S. Hart, *ibid.*, No. 60, 10 (1952).
2. R. B. Cowles and C. M. Bogert, *Bull. Am. Museum Nat. Hist.* 83, 277 (1944).
3. Unpublished.

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21 March 1955

Effect of N-m-Tolylphthalamic Acid on Tomato Flower Formation

The *N*-arylphthalamic acids were first described by Hoffman and Smith [*Science* **109**, 588 (1949)] with regard to their influence in promoting fruit set in the tomato. We have subsequently found *N*-*m*-tolylphthalamic acid of practical value for promoting early fruit set of field-grown tomatoes when cool nights often prevent normal pollination of the first flowers.

In the spring of 1954, this chemical at a concentration of 200 parts per million (ppm) was applied to the foliage of eight tomato varieties in an attempt to promote early fruit set under greenhouse conditions. Three consecutive sprays were applied at approximately 2-wk intervals at anthesis of each of the first three clusters. Since environmental conditions were favorable, no influence of the chemical on fruit set was noted. However, it was observed later that the number of flowers, beginning with the fourth cluster of treated plants, was strikingly increased. This increase in flowers was accompanied by greater numbers of fruit on the fourth to seventh clusters (Table 1).

A field study during the summer of 1954 on 40 tomato varieties included both determinate and indeterminate types. During flowering of the first clus-

Table 1. Effect of *N-m*-tolylphthalamic acid (200 ppm) applied at anthesis of the first, second, and third flower clusters on the number of flowers and fruit in successively developing clusters of the tomato

Cluster No.	Flower number			Fruit set		
	Control	Treated	Increase	Control	Treated	Increase
1	7.3	7.2	− 0.1	7.1	7.2	0.1
2	7.2	8.0	0.8	6.9	7.2	0.3
3	6.7	8.4	1.7	6.3	6.3	0.0
4	7.4	11.7	4.3	6.1	5.5	−0.6
5	7.3	18.7	11.4	5.7	7.5	1.8
6	6.8	20.6	13.8	5.8	9.1	3.3
7	6.5	18.1	11.6	5.3	10.9	5.6
LSD 5% (Cluster × treatment)			5.4			1.5
LSD 1%			7.1			1.9

ters in June, three consecutive weekly applications of *N-m*-tolylphthalamic acid (200 ppm) were made to randomized rows in replicated blocks of all varieties. Although the normally determinate varieties were not appreciably affected, growth of the main axis of all indeterminate varieties terminated by 25 July in clusters of 50 to more than 100 flowers. This effect on flowering in the field was more pronounced than that observed in the greenhouse and resulted in delayed maturity and a decrease in total production.

Previous observations suggested that the visual effect of the chemical on flower number occurred approximately 6 wk after treatment. Since anthesis of the first flower cluster on standard tomato varieties grown at night temperatures of approximately 60°F usually occurs 6 to 8 wk after cotyledon expansion, treatment at an early seedling stage might affect the number of flowers differentiated in the first cluster. Groups of seedling tomato plants (var. Michigan State Forcing) were treated at cotyledon expansion or 1 wk later with five concentrations (50, 100, 200, 300, and 400 ppm) of *N-m*-tolylphthalamic acid. The numbers of flowers differentiated in the first clusters are listed in Table 2. Treatment at cotyledon expansion had no effect on flower differentiation, but application of 300 ppm 1 wk later showed an increase in flower number that was significantly greater than that in the controls. The number of nodes preceding the first flower cluster, however, was not altered. Although the number of flowers was also increased by 400 ppm, the main axis tended to terminate with the first flower cluster. Observations of flower number in later developing clusters established that treatment 1 wk subsequent to cotyledon expansion affected only the number of flowers in the first cluster.

Thus it appears that, in addition to promoting fruit set of the tomato plant, *N-m*-tolylphthalamic acid may influence flower formation in later developing clusters and if applied to young seedlings will increase flower number in the first cluster. It and other *N*-arylphthalamic acids are suggested for further studies of flowering and fruiting in higher plants.

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Table 2. Effect of *N-m*-tolylphthalamic acid applied at cotyledon expansion and 1 wk later on the number of flowers in the first cluster of the tomato

Concentration	Cotyledon expansion	1 week after cotyledon expansion
Control	6.2	6.0
50 ppm	5.9	7.0
100 ppm	6.2	8.0
200 ppm	6.4	8.0
300 ppm	5.7	9.1*
400 ppm	5.7	9.1*
Mean	6.0	7.9†

* Differ significantly from the control at the 1-percent level.
† Difference between early and late treatment significant at the 1-percent level.

Chalconatronite, a New Mineral from Egypt

The occurrence of a new mineral, chalconatronite, has been observed among the corrosion products of three ancient bronze objects from Egypt. The name is given in allusion to its composition as a double carbonate of copper and sodium from the Gr. *chalcos*, copper, and *natron* (Ar. *natrūn*), the modern name for naturally occurring sodium carbonate. Two of the occurrences are from the hollow interior bases of bronze figures of the Saite-Ptolomaic Period (663–630 B.C.), and the third is from the under surface of a bronze censer (Freer Gallery of Art, 52.1) of the late Coptic Period of Egypt (before 8th century A.D.). Nothing is known about the exact origin of the bronzes in Egypt, but presumably they were long buried in the earth.

Chalconatronite is found as a fine-grained, greenish-blue crust, associated with cuprite and atacamite. Chemical analysis of the product from the base of the first figure, a seated Sekhmet (lion-headed female deity) in the collection of the Fogg Museum of Art, Harvard University (No. 1943.1121a) shows the following percentages: Na_2O, 20.0; CuO, 26.8; CO_2, 29.5; H_2O, 20.4; PbO, 2.8; SiO_2, 0.5; R_2O_3, 0.6; total, 100.6. The formula is $Na_2Cu(CO_3)_2 \cdot 3H_2O$. The lead is an impurity derived from lead admixed with the parent metal, Cu-Sn bronze. The mineral is partially soluble in water with decomposition and completely soluble with effervescence in cold dilute acids.

Chalconatronite is the sixth natural carbonate to be described that contains copper as an essential constituent. These include malachite, azurite, aurichalcite, rosasite and voglite. Of these only malachite, azurite, and the present species have been observed as alteration products on ancient metal objects.

The crystals are probably monoclinic. Many are in the form of small, pseudohexagonal plates; others are lath shaped. The substance is highly birefracting and distinctly pleochroic. The optical properties are n X = 1.483 (nearly colorless), n Y = 1.530 (pale blue), n Z = 1.576 (blue); 2V large, probably positive; Z perpendicular to flattening of the crystals; Y parallel to elongation of the laths; $Z \wedge c$ apparently very small.

The hardness is low and the mineral tends to be a little chalky; specific gravity is 2.27 ± .03.

The x-ray powder diffraction pattern is sharp. The *d* spacings of the five strongest lines, listed in order of decreasing intensity, are 6.92, 4.17, 3.68, 2.87, and 2.42 A.

The formation of chalconatronite appears to result from the reaction of surface or subsoil waters carrying alkali carbonates in solution, either directly with the copper alloy or with intermediate alteration products, such as malachite or atacamite. Waters of this type characterize the arid regions of Egypt. Conditions in the hollow interiors of bronze objects seem to favor the formation of unusual mineral types.

Although this naturally occurring compound seems not previously to have been described, the corresponding artificial substance has long been known. A summary account of the chemistry of the synthetic compound $Na_2Cu(CO_3)_2 \cdot 3H_2O$, first prepared by Deville in 1852,

is given by J. W. Mellor [*Comprehensive Treatise on Inorganic and Theoretical Chemistry*, vol. III, p. 276]. A product closely similar in chemical composition, particle characteristics, and optical properties was made in this laboratory simply by grinding in a mortar copper acetate with a saturated solution of sodium carbonate, filtering, washing, and drying. A fuller account is in preparation.

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Response of Nasal Epithelium to Odor Stimulation

An *in vitro* preparation of nasal epithelium has been developed in order to study its response to odors in a most direct manner. (This work was supported by a grant from the Armour Research Foundation and by the Research Council of Florida State University.) The opossum contains a large yellow olfactory area. A 2-cm² sheet of this tissue was carefully removed and placed in a flat lucite chamber that allowed one to dissect, under high magnification, the nerves from the richly innervated epithelium. The underside was supported by lucite except for a 1-cm² surface that could be exposed to either purified room air or one of a number of different odors.

Recordings were made from very small branches of nerves. Mechanical stimulation of the tissue resulted in very large spikes, whereas only small spikes were recorded in response to odors. These small nerves conducted spikes at about 0.4 m/sec to 1.0 m/sec. Single fibers were rarely seen to respond at a frequency greater than 8 to 15 per second.

Odors were obtained by allowing an air stream to pass over the surface of 5 ml of odorous liquid contained in a 50-ml erlenmeyer flask at the rate of 30 ml/min. A portion of this stream was allowed to diffuse into the air 1 cm below the surface of the epithelium.

Most preparations that contained a number of active fibers showed resting activity. Odors such a amyl acetate, benzene, cajeput, eucalyptus, leaf cloves, spruce, Florida orange, asafetida, 2-furaldehyde, and freshly ground coffee beans stimulated a number of such preparations, and the nerve activity increased markedly.

The percentage increase in the number of spikes per second above resting activity of a given preparation as various odors were presented for 30 sec is as follows: amyl acetate, 110; cajeput, 42; spruce, 27; Florida orange, 21; leaf cloves, 0; musk xylol, 0. A 5-min rest in purified air was given after each odor stimulation. High concentrations of amyl acetate may have a detrimental effect.

A nerve bundle containing only a few active fibers reveals that one fiber may not respond to a given odor as well as another fiber, although this relationship may be reversed if a different odor is chosen. Figure 1 shows the response of a few-fiber preparation to various odors. Note that the same fibers do not respond to all the odors.

The nasal epithelium in the olfactory region is innervated by both olfactory and trigeminal nerve fibers. The type of stimuli to which the preparation responds and the slow conduction velocity of the nerves suggest that the recordings are from olfactory nerves. On the other hand, some nerve twigs contain a few large fibers that respond to mechanical stimulation, which suggests that trigeminal nerves may be involved. For these reasons, a live-rabbit preparation was devised so that the responses to odors could be recorded from the olfactory nerves as they passed through the cribriform plate (Fig. 2). Such results were compared with those recorded from known trigeminal nerves of the same rabbit. Both of these nerves responded to most of the stimuli chosen. Therefore, the olfactory and trigeminal systems are much more similar in the type of stimuli to which they respond than was previously realized.

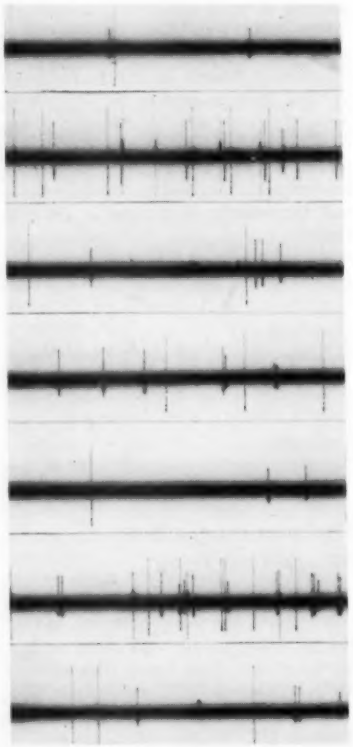

Fig. 1. The response of a few-fiber preparation to various odors. Several minutes elapse between each record. Top to bottom: air, 2-furaldehyde, air, heptane, air, coffee, air. One-half-inch horizontal space represents 1 sec.

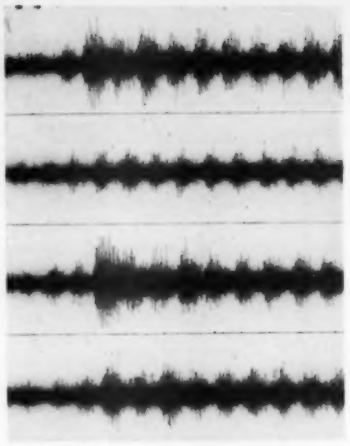

Fig. 2. Response of olfactory nerve twig to odors inhaled during breathing under anesthesia. Top to bottom: amyl acetate, benzyl benzoate, *n*-heptaldehyde, eucalyptus. One-half-inch horizontal space represents 1 sec.

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Manometer Flask for Measuring Respiratory Quotients

Although the methods presently available for measuring respiratory quotients (RQ) provide insight into patterns of metabolic changes, they leave much to be desired, both in ease of manipulation and validity of the results (*1*, *2*). With these methods the measurement of changes in the RQ over extended and varying periods of time on the same tissue sample is usually impossible (*3*).

The techniques that permit the measurement of RQ rates at different or continuous intervals, such as those described by Laser and Rothschild (*4*), Noyons, (*5*), Prop (*6*), Asprey (*7*) Wolf *et al.* (*8*), and Gaffron (*9*), require elaborate equipment and considerable manipulation. Other manometer flask modifications that are used for RQ determinations measure the net oxygen uptake and carbon dioxide evolution over a period

of time. At the end of the study, the amount of carbon dioxide produced is determined by admitting alkali into the vessel (*10*). In these latter methods, the assumption is made that the RQ is constant during the interval of measurement, a condition that is often not the fact (*1, 4*). To obviate these difficulties and to permit a rapid, valid measurement of the RQ, a modification of the standard Warburg flask has been developed for use with a constant-volume respirometer.

The RQ measuring flask (*11*) permits the determination of the carbon dioxide production and the oxygen uptake of a single tissue sample during immediately adjacent intervals, thus eliminating the need for duplicate samples in two separate flasks. The flask (Fig. 1) has one or two hollow stopcock side arms into which folded filter paper and alkali are placed. These side arms replace the usual center well. The hollow stopcock has a large hole (bore) in one side that opens into the central chamber and exposes the absorption surface of the filter paper to the vessel atmosphere. When the stopcocks are in the open positions, the flask measures oxygen uptake in the same way that a standard flask with alkali in the center well does. When the stopcocks are closed, the flask serves as the pair member without alkali in the Warburg direct method (*12*).

The procedure for determining the RQ involves the use of three different time intervals, the first two of which are equal in length. In the first interval, the stopcocks that contain KOH are opened into the chamber, and the change in pressure is proportional to the oxygen uptake; during the second interval, the stopcocks are closed off, and the change in pressure is proportional to the net effect of the carbon dioxide produced and the oxygen uptake. The change in pressure recorded on the manometer during these two intervals, together with the known vessel constants, permits the computation of the RQ (*13*). In the third interval, the stopcock is again opened in order to permit the absorption of the carbon dioxide released during the second and third intervals; this sequence, starting with the first interval, may then be repeated. In principle, this procedure is similar to the one recommended for a flask by Gaffron (*9*).

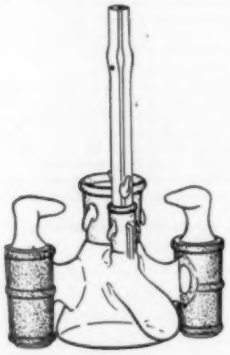

Fig. 1. Manometer flask for measuring respiratory quotients.

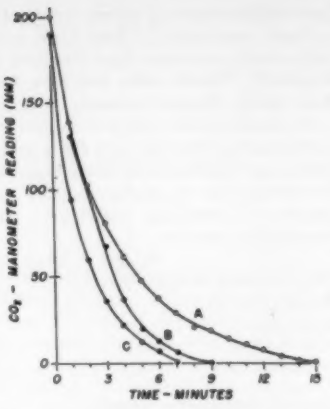

Fig. 2. Effectiveness of RQ flask in absorbing carbon dioxide. (*A*) RQ flask with one alkali-containing stopcock; (*B*) standard flask with center well; (*C*) RQ flask with two alkali-containing stopcocks. The vessels were of 6- to 7-ml volume; similar results were obtained with vessels of 20-ml volume. The main compartment contained 0.5 mg of Na_2CO_3; 0.25 ml of 10-percent oxalic acid was added from the side arm at zero time. Stopcocks contained 0.15 ml of 20-percent KOH and filter paper. The center well contained 0.05 ml of 20-percent KOH and filter paper. Bath temperature was 30°C; Lardy-type Warburg, shaking at 112 oscillations/min.

One recognized limitation of the standard flask is the rate at which the alkali in the center well absorbs carbon dioxide. Figure 2 compares the rate of carbon dioxide absorption in the RQ flasks with that in the standard Warburg flasks. It is apparent that the RQ flask with both stopcocks open is as efficient in carbon dioxide absorption as is the standard Warburg flask with KOH and filter paper in the center well. By using the procedure of Dixon and Elliott (*14*), the time required to absorb a given volume of carbon dioxide may be computed. Thus, the shortest time interval can be determined for which each flask may successfully be used with a given rate of carbon dioxide evolution. In studies conducted upon germinating seeds at this laboratory, the rate of evolution of carbon dioxide and of change in RQ has been well within the absorption capacity of all flasks in use.

A more serious limitation of the standard Warburg flasks, which is in part circumvented by the use of these RQ flasks, is that certain tissues and cells give significantly different respiratory patterns and rates when they are in an atmosphere in which the carbon dioxide tension is reduced to zero (*3*). In the RQ flask the tissue is respiring in the absence of carbon dioxide for only the minimal amount of time required to measure the oxygen uptake; this is closer to the ideal situation than is the case in the usual Warburg direct method.

Other suggested uses of the RQ flask are for the measurement or absorption of metabolically produced hydrogen (*15*) and for the measurement of ethylene production (*16*).

Precautions must be taken to acquire the technique of opening and closing the stopcocks without disturbing the positions of the flasks on the manometers. But, as with other manipulative manometric procedures, only time, patience, and an awareness of the potential defects will permit the successful application of the instrument (*17*).

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References and Notes

1. W. O. James, *Plant Respiration* (Oxford Univ. Press, London, 1953).
2. W. Stiles and W. Leach, *Respiration in Plants* (Wiley, New York, ed. 3, 1952).
3. M. Dixon, *Manometric Methods* (University Press, Cambridge, England, ed. 3, 1951).
4. H. Laser and Lord Rothschild, *Biochem. J. (London)* 43, 598 (1949).
5. A. K. M. Noyons, *Ann. physiol.* 13, 909 (1937).
6. F. J. A. Prop, *Exptl. Cell Research* 7, 303 (1954).
7. G. F. Asprey, *Proc. Roy. Soc. Edinburgh* B63, 163 (1948).
8. J. M. Wolf, A. H. Brown, D. R. Goddard, *Plant Physiol.* 27, 70 (1952).
9. H. Gaffron, *J. Gen. Physiol.* 26, 241 (1942).
10. M. Dixon and D. Keilen, *Biochem. J. (London)* 27, 86 (1933); M. Rabinovitz and J. Ingraham, *Science* 114, 498 (1951).
11. Available from Microchemical Specialty Co., 1834 University Ave., Berkeley 3, Calif.
12. O. Warburg, *Hoppe-Seyler's Z. physiol Chem.* 92, 231 (1914).
13. W. W. Umbreit, R. H. Burris, J. F. Stauffer, *Manometric Techniques and Tissue Metabolism* (Burgess, Minneapolis, 1949).
14. M. Dixon and K. A. C. Elliott, *Biochem. J. (London)* 24, 820 (1930).
15. H. Gaffron and J. Rubin, *J. Gen Physiol.* 26, 219 (1942).
16. R. E. Young, H. K. Pratt, J. B. Biale, *Anal. Chem.* 24, 551 (1952).
17. F. L. Wynd, *Lloydia* 15, 1 (1952).

26 April 1955

Geologic Application of a Test for Citrate-Soluble Metals in Alluvium

One of us has described a procedure for determining the content of citrate-soluble heavy metals, principally zinc, copper, and lead, in geologic materials (*1*). This is a rapid and simple procedure readily adaptable to use in the field at the collecting site.

Experiments with this test in 1953 in New Brunswick and the Gaspé Penin-

sula of Quebec, Canada, have shown that the citrate-soluble metal content of stream alluvium is a useful method of appraising the possibilities of mineral deposits in the area upstream from the sample site. Samples of alluvium may be taken either from the active bed of the stream or from terrace deposits. Field trials showed the presence of trains of alluvial material containing a higher-than-normal quantity of extractable metal for distances up to 4 mi, and in one case for 50 mi downstream from the deposits. The content of extractable metal depends to a certain degree on the grain size, organic content, and mineral composition of the sample as well as on the distance from the source.

On the basis of these experiments and subsequent experience, regional surveys of the citrate-soluble heavy-metal content of stream alluvium is recommended as a reconnaissance method of mineral exploration.

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HAROLD BLOOM
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References

1. H. Bloom. *Additional Field Methods Used in Geochemical Prospecting* (Released by U.S. Geological Survey as open-file report, 16 Sept. 1953, pp. 28–31; *Econ. Geol.*, in press.

21 April 1955

Statistics

As a nonstatistician user of statistical methods, I feel moved to reply to the communication from Frederick Sargent, II, [*Science* **121,** 402 (18 Mar. 1955)]. There is a danger, in my opinion, that the very real case against indiscriminate use of correlation analysis may be stultified by the continued citation of nonsense correlations to support it. That noncausal correlations do exist has already been adequately demonstrated. Offhand I can think of the correlation between birth rate and marriages in the Church of England, and that between stage of the Potomac River and street traffic flow in Washington, D.C., adduced respectively, I believe, by Pearson and Ezekiel.

Actually, the correlations found are but formalizations of common-sense statements: "The summer months, when both precipitation and temperature are high (in Chicago) have shorter names than the others" (the "r" months have provided centuries of oyster eaters with a handy mnemonic); "Both birth rates and church marriages have declined in England"; "Street traffic and river flow have similar diurnal variations."

It would be more useful to students to point out forcibly the need for *a priori* biological hypotheses for correlations to be tested than to produce further examples of noncausal correlations, no matter how amusing.

RALPH P. SILLIMAN
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11 May 1955

Steroid Anesthetic Agent

Since Selye (*1*) and others reported the central depressant action of certain steroidal hormones, little attention has been given to the quantitative and qualitative comparison of the anesthetic action of steroids and the commonly used anesthetics. The possible use of this type of compound in clinical anesthesia led us to study the relationship of chemical structure to activity in a series of steroids. 21-Hydroxypregnane-3,20-dione sodium succinate (hydroxydione) (*2*) was found to be the most promising of a number of water-soluble steroids. The marked anesthetic action, solubility in water, and lack of endocrine activity and other side effects have justified the evaluation of this compound in man as an intravenous anesthetic (*3, 4*).

On intravenous injection, anesthesia is produced by hydroxydione in mice, rats, cats, dogs, and monkeys (*5*). In the mouse and rat the most striking features of hydroxydione are its remarkably high anesthetic potency, which equals that of Pentothal Sodium (thiopental sodium), and its therapeutic index, which greatly exceeds that of the thiobarbiturate (see Table 1). However, in cats, dogs, and monkeys, hydroxydione is not as active (milligram for milligram) as thiopental sodium is. In dogs, hydroxydione at 100 mg/kg compares in effectiveness with 25 mg of thiopental sodium. However, hydroxydione is much less toxic than thiopental sodium—three of seven dogs died after intravenous injection of 50 mg of thiopental sodium per kilogram of body weight, but only one of eight dogs died after intravenous injection of 300 mg/kg of hydroxydione.

Table 1. Comparative intravenous anesthetic potencies of thiopental sodium and hydroxydione in mice

Compound	AD_{50} (mg/kg)	LD_{50} (mg/kg)	TI (LD_{50}/AD_{50})
21-Hydroxypregnanedione sodium succinate (hydroxydione)	21.5	250	11.5
Thiopental sodium	19.5	80	4

Other advantages of the anesthesia produced are the relatively low degree of respiratory depression and rapid uncomplicated recovery with minimum postanesthetic depression. Little or no endocrine activity can be demonstrated after administration of large doses of hydroxydione to experimental animals (*6*).

In view of the striking pharmacological effects of hydroxydione, it is of interest to reconsider the possible actions of endogenous hormones and their metabolites on the central nervous system, such as in central control of anterior pituitary secretion, where certain analgesics and hypnotics have been shown to exert marked effects. Other central actions of hydroxydione, such as effects on brain metabolism (*7*) and electroshock threshold (*8*), as well as effects in combination with other drugs, are being investigated and will be reported subsequently.

G. D. LAUBACH
S. Y. P'AN
H. W. RUDEL
Chas. Pfizer and Company, Brooklyn, New York

References and Notes

1. H. Selye, *Endocrinology* 30, 437 (1942).
2. 21-Hydroxypregnanedione acid succinate was prepared by a synthesis involving the catalytic hydrogenation of desoxycorticosterone followed by succinoylation, mp 195°–197°C; $[\alpha]_D$ + 95° ($CHCl_3$); $\lambda\lambda_{max}^{KBr}$ 5.70, 5.87, 7.01, 7.21, 7.36, 7.68, 8.60, 8.99; M.W. 432; the sodium salt was prepared as a white free-flowing lyophilate, readily soluble in water or mildly alkaline buffer solutions. Viadril® brand of hydroxydione is the registered trademark of Chas. Pfizer and Co., Inc., for hydroxydione, 21-hydroxypregnane-3,20-dione sodium succinate.
3. G. S. Gordan *et al.* have studied hydroxydione in a number of patients and have found this agent to be a safe, convenient, and practical basal anesthetic for surgical procedures in man. Report is in preparation.
4. During the course of our clinical studies, a report appeared in which sleep was induced in man by intravenous administration of progesterone [W. Merryman *et al.*, *J. Clin. Endocrinol. and Metabolism* 14, 1567 (1954)].
5. S. Y. P'an *et al.*, in preparation.
6. J. F. Gardocki and S. Y. P'an, in preparation.
7. G. S. Gordan and H. W. Elliott, *Endocrinology* 41, 517 (1947).
8. D. M. Woodbury, *J. Pharmacol. Exptl. Therap.* 105, 27 (1952).

23 May 1955

Book Reviews

Clinical versus Statistical Prediction. A theoretical analysis and a review of the evidence. Paul E. Meehl. Univ. of Minnesota Press, Minneapolis, 1954. x + 149 pp. $3.

As a clinical, as well as an experimental, psychologist, the author confines himself to an examination of the question posed by his title in the field of psychology. He defines statistical prediction as the mechanical combination of data for classification purposes and determination of a probability figure derived from empirical relative frequencies. Clinical prediction proceeds through the formulation of a psychological hypothesis about the individual, perhaps in a psychiatric staff conference. That is to say, clinical prediction is characterized by nonmechanical combination of given data. The author, in this volume, is not concerned with a comparison of the usefulness of psychometric and nonpsychometric data for predictive purposes.

Paul Meehl takes great care in examining, in principle, the special predictive activity of the clinician, particularly in the conduct of the clinical interview. He disagrees with the position of T. R. Sarbin that clinical prediction is fundamentally actuarial. Instead, he suggests that high-level clinical hypothesizing is akin to the psychological processes involved in the creation of scientific theory. However, Meehl is aware that his argument is not quite as solid as might be desired.

There is a chapter devoted to a thorough review of the surprisingly scant literature of empirical comparisons between clinical and statistical prediction. In the narrow range of problems studied, the statistical approach shows itself somewhat superior to the clinical, although optimum statistical weighting procedures frequently are not used. Much remains to be done to determine the proper domains of statistical prediction on the one hand and clinical prediction on the other. Meehl's present conclusion is that the statistical method is preferable, when socially defined outcomes, such as duration of disease or success in training, are to be predicted. In any case, although we may choose the nonactuarial approach under certain circumstances, it has to be validated by the use of statistical methods.

This book, although written in an informal, pleasant style, contains much technical material of primary interest to the psychologist; however, persons facing similar problems in other fields, as for instance in medicine, will also benefit from this fair-minded, stimulating clarification of a thorny issue.

LEE HERRERA
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Pharmacology in Medicine. A collaborative textbook. Victor A. Drill, Ed. McGraw-Hill, New York–London, 1954. xii + 87 chapters + index. Illus. $19.50.

Pharmacology in Medicine is a collaborative textbook and reference edited by Victor A. Drill, lecturer in pharmacology, Northwestern University Medical School, formerly professor of pharmacology, Wayne University College of Medicine. It includes contributions and discussion presented by some 81 authorities in their respective fields of speciality.

It is presented in a uniformative and authoritative method for quick reference by students, physicians, and other members of the allied professions alike. The clinical approach is outstanding in offering to the students and members of the profession an opportunity to keep abreast of virtually the most recent advances in therapeutics and to acquire the basic principles and theories necessary for rational use of drugs in current use as well as a knowledge for the evaluation of those to be introduced later.

The system used for numbering pages is something relatively new. Each chapter is numbered as a separate entity by chapter and page, for example, 1/1, 1/2, 1/3, 2/1, 2/2, 3/1, 3/2, and so forth. This method of numbering has the advantage of grouping related material by page numbers, as well as by chapter heading, and facilitates reference.

It is closely correlated with the related medical sciences in scope. The most recent and important advances in medicine serve as a basis for the interpretation of action and uses of drugs. The application of pharmacodynamics to therapeutics is emphasized. Among the recent additions in books of this sort under chapter headings are "General anesthesia: intravenous agents," "Drugs in epilepsy and hyperkinetic states," "Veratrum alkaloids," "Insecticides, rodenticides and agricultural poisons," "Oral and intravenous feeding."

In addition to the specific chapters mentioned, ideas are expressed on anticarcinogenic agents and others that have not found extensive therapeutic use. Description of newer concepts and/or correlative data is presented under one heading in chapters on "Drug addictions," "Respiratory reflexes during anesthesia," "The role of the skeleton in pharmacological and toxicological responses."

The organization of the book, for the most part, is in the standard manner acceptable to students and practitioners. The chapter on prescripiton writing and drug preparation is well presented and, at the same time, presented in light of current trends and practice.

The contributors assembled by the editor are stimulating and informative and detailed in their outlook and their methods of presentation. All information is well documented and evaluated. This should easily become recognized as an important book, especially to the students of pharmacology, medicine, and dentistry.

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Standard Values in Nutrition and Metabolism. E. C. Albritton, Ed. Saunders, Philadelphia–London, 1954. xiii + 380 pp. Illus. Paper. $6.50.

Like the pockets of a typical healthy boy, this impressive monograph is packed full of a large variety of things, many of which may seem to be somewhat unrelated. Nevertheless it must be concluded that the monograph will serve a useful purpose through the concise assemblage of enormous amounts of information.

The work was compiled from the contributions of more than 800 specialists in widely varied fields of the biological sciences. There are 223 pages of tables and 16 pages of diagrams covering the nutrients necessary for plants, fungi, yeasts, bacteria, protozoans, invertebrates, vertebrates, and so forth; nutrients utilized by various animal forms and plant forms; daily nutrient allowances for man, dog, rat, and a host of other animal forms; diets and culture media for a great variety of animals; culture media and fertilizers for various plants; nutrient and energy values of foodstuffs and feedstuffs; signs of nutrient deficiencies and excesses; pathways of metabolism; end-products of metabolism; rates of respiration; and

various other topics. Moreover, there is an extraordinarily large number of references that are so successfully linked to the tables that the source of specific items in the tables can be readily identified.

The enormous effort that created this monograph was under the joint sponsorship of the U.S. Air Force, Army, Navy, and Atomic Energy Commission, but the direction of the enterprise was the responsibility of the Committee on the Handbook of Biological Data, a unit of the American Institute of Biological Sciences.

Because a tremendous amount of data were handled in the preparation of the monograph, it is little wonder that there are some errors and some contestable interpretation of knowledge as portrayed in some of the diagrams. For example, the summation of lipid digestion and absorption (p. 179) is at least slightly erroneous, and it is questionable that fat per se is needed only as a source of essential fatty acids (p. 67). There may be additional needs for fat. Some errors were noted in the references. On the whole, however, the monograph appears to be remarkably accurate.

Biological scientists in general may be expected to have occasional need for this handbook, and students will find that many of the diagrams are unusually illuminating.

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Human Heredity. James V. Neel and William J. Schull. Univ. of Chicago Press, Chicago, 1954. vii + 361 pp. Illus. $6.

This new textbook on the formal genetics of man has a refreshingly different approach. It does not replace the older books on this subject but supplements them by covering much ground not adequately reviewed elsewhere. It will very probably satisfy an important need in this field for many years.

The presentation of the principles of monofactorial inheritance departs from the traditional method by including sex-linked, partially sex-linked, and holandric genes along with the general discussions of autosomal dominant and recessive genes. This has the advantage of placing the emphasis on the physiologic action of the gene rather than on pedigree form. From the teaching viewpoint, there are also advantages to a separate discussion of sex linkage. Fortunately, the book is so organized that an instructor could use either approach by making appropriate assignments in the text.

Probably the best feature of the presentation is the constant attention given to the statistical problems that are essential to an understanding of the subject. The authors state that they wish to emphasize the methodology of human genetics, and this they do very well. They warn that the reader without preparation in the calculus and biometry may experience difficulty, but they offer no apology and insist that such knowledge is essential to the serious student of human genetics. Although this may place a part of the text beyond the reach of many students and restrict its use to advanced courses, it also makes it a much more valuable work for advanced students and investigators.

In view of the wide variety of special statistical tests that have been proposed to test genetic hypotheses under varying conditions of data collection and to estimate various useful parameters, the authors have done an admirable job of generalizing and choosing the most useful methods for discussion. Maximum likelihood methods of estimation are used wherever possible, often to the exclusion of less efficient procedures. Several procedures are described that are not widely known and are difficult to find elsewhere. For example, Penrose's ϕ-statistic is a useful tool whose potentialities are rarely recognized. Owing to limitations of space, the worked examples omit most of the computational steps; but, since the correct results are stated, this should serve as a challenge to the student. Well-selected problems are given at the ends of most chapters, and several abridged tables useful in computation are included.

The discussions of genetic principles as applied to man are clear and concise. Population genetics, mutation, physiologic genetics, and other topics are treated as adequately as would seem possible in the available space, with intelligent choice of topics. In a number of places the authors indicate their opinions on the probable value of various possible avenues of future research. It is of interest to contrast their enthusiastic evaluation of many of these with their rather pessimistic view of the possibilities in linkage studies and twin studies.

The practical applications of genetics to human problems are grouped in the last three chapters under the headings of genetic counseling, medicolegal applications, and eugenics. The chapter on advice to families is excellent, with a realistic and understanding view of the many complex factors that must enter into any genetic counseling problem. On the other hand, the chapter on eugenics discloses a surprisingly conservative approach, and the authors are apparently under some misapprehensions concerning the modern "eugenics movement."

In summary, this book is generally of excellent quality. It will be quite useful as a textbook to advanced students in human genetics and to investigators in this field. It should also be of particular interest to medical investigators whose research leads them into areas where genetic factors are of importance. The mathematical training required will limit its use as a textbook by medical students and beginning students of genetics. The book is well indexed and is bound and printed in an attractive format.

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An Introduction to Molluscan Ecology. Distribution and population studies of fresh-water molluscs. Alan Mozley. Lewis, London, 1954. x + 71 pp. Illus. 9s.

The title of this book is a little misleading, since it is more a brief and partial summary of the ecology of a very few species of mollusks rather than an introduction to this vast subject. In fact, most of the data given are limited to a few fresh-water pulmonate snails of northern latitudes and a somewhat more detailed account of a few African pulmonate snails responsible as vectors for bilharziosis (schistosomiasis). Although the book has a subtitle of "Distribution and population studies of fresh-water molluscs," there is hardly any mention of fresh-water bivalves or fresh-water Prosobranchs. These two groups together outnumber the pulmonates by 10 to 1. Nevertheless, there are many observations made by an experienced field man on the ecology of these animals and methods of control of the disease-carrying forms.

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Fishes of the Western North Atlantic. Sawfishes, guitarfishes, skates, rays, and chimaeroids. Henry B. Bigelow and William C. Schroeder. Sears Foundation for Marine Research, Yale Univ., New Haven, Conn., 1953. Memoir 1, pt. 2. xvi + 588 pp. Illus. $15.

This book, carefully and accurately prepared for the layman and the specialist, forms part two of an ambitious project supported by the Sears Foundation for Marine Research. The general treatment and format are the same as those for part one, which was published in 1948 and included lancelets, cyclostomes, and sharks. The printed date of publication "1953" is in error since part two was not distributed until 1 Dec. 1954, the date it was mailed from Denmark.

Under each species the following sections occur: study material, distinctive

characters, descriptions, color, size, developmental stages, habits, relation to man, abundance, range, details of occurrence in the western Atlantic, synonyms, and references. On pages 187–194, Merriman, Olsen, Wheatland, and Calhoun record the life-history and habits of *Raja erinacea*.

Those who use part two will be amazed to find 1388 footnotes on 562 pages. This distracts the reader who must search for the footnotes; at least 80 percent of this material would be better included in the text.

This book includes 27 genera and 67 species, which make a total of 66 genera and 137 species for the two big volumes. On the basis of an estimate of 1000 fish species in the "western North Atlantic," the present rate of completion of this project will occupy the indefinite future, with a minimum of 13 more volumes. The editorial board may need to alter present plans sufficiently to expedite the completion of this important undertaking in a reasonable length of time.

Some ichthyologists may question the authors' concept of a species in parts one and two, since in those few cases where many specimens were available, a statistical appraisal of morphologic characters used in distinguishing closely related forms is lacking. This cannot be considered as a too serious weakness in the first two volumes, for where large fishes are involved, such as sharks and rays, only a few specimens of a species, sometimes only a single specimen, are preserved in museums. Whereas, when small species of bony fishes are involved usually extensive series from numerous localities are available for statistical studies.

However, those who use part two may have complete confidence in this work. The classification and nomenclature are conservative, and the drawings were expertly prepared. The discussions, descriptions, and conclusions were written with mature judgment and are presented with deliberate and painstaking care.

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Feeding Poultry. Gustave F. Heuser, Wiley, New York; Chapman and Hall, London, ed. 2, 1955. viii + 632 pp. Illus. $7.50.

In this edition the author has provided an almost new textbook in that it has been nearly rewritten. It brings together the practices of feeding and the science of poultry nutrition.

On the whole, the book is well organized and clearly written. It begins with the feeding problem and the objectives in poultry feeding, then moves on to a discussion of the nutrients and ingredients used, the essential factors in a poultry diet, and systems and practices of feeding. The last part deals with the feeding of chickens for specific functions and the feeding of turkeys, waterfowl, and other species of birds. A number of recommended rations is included in the appendix.

Although no attempt is made to include all the poultry nutrition studies reported in the literature, an extensive list of references is given at the ends of the chapters for the interest of those who wish additional information. The author has attempted to evaluate contradictory information, thus saving the reader the time and effort of interpretation.

Heuser states that the book is designed to meet the needs of poultry students, practical poultrymen, feed dealers, and others interested in poultry feeding. Since he has emphasized the practical more than the technical phases, he has accomplished his objective.

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Linear Equations in Applied Mechanics. H. F. P. Purday. Oliver & Boyd, Edinburgh–London; Interscience New York, 1954. xiv + 240 pp. Illus. $3.50.

Much of the mathematical structure underlying the physical theories that the engineer deals with in the fields of mechanical vibrations, flow of fluids, heat, electricity, automation, and so forth, is linear analysis. The common structure of linear algebraic equations and functional equations of various kinds has been recognized and exploited for a long time.

According to the author's preface, "The object of this book is to help readers with an elementary knowledge of the calculus to get acquainted with the easier aspects of linear algebraic equations, difference equations, ordinary and partial differential equations, and integral equations as well as the associated ideas of matrices, determinants, invariants, vectors, tensors, conjugate functions, orthogonal functions, series, etc." This is a very worth-while undertaking, and the book is the more valuable because it includes an account of the more elementary methods of solution by numerical, mechanical, and electric means of computation. A good deal of numerical work applied to actual engineering problems is given in full.

No attempt is made at mathematical rigor, and mathematical proofs are almost entirely absent. This is as it should be in a book of this kind. On the other hand, one would expect that strict mathematical reasoning would be replaced by appeal to intuition, by emphasis on analogies, and by extensive motivation of the procedures described. However, there is very little of this in the book. Tensors are introduced as quantities that transform according to a certain rule, but why this rule is chosen and no other is nowhere explained. The product of matrices is defined as an arbitrary convention with no mention of the fact that it follows logically from the result of successive linear substitutions.

The unifying concept of all linear analysis, that of linear transformation, is not discussed at all, and the term *linear operator* is not even mentioned. Matrices are employed only for convenience of notation, with no allusion to their operational aspect. Because of this lack of logical integration and motivation, the book has the character of a technical manual. One also questions the didactic value of its organization. The elementary arithmetic of complex numbers is taken up in some detail close to the end, with a two-page treatment of integral transforms including Laplace's following a few pages later and a few brief paragraphs on the theory of linear integral equations at the end.

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Le Magnétisme des Corps Célestes. vol. 1, **Magnétisme Solaire et Stellaire Couronne Solaire et Lumière Zodiacale.** vol. 2, **Variations et Origine du Géomagnétisme.** parts II and III of *Physique Cosmique*. A. Dauvillier. Hermann, Paris, 1954. vol. 1, 171 pp. Illus. + plates. Paper, F. 1600. vol. 2, 161 pp. Illus. + plates. Paper, F. 1500.

These two volumes by the well-known professor of cosmic physics at the University of France have as their object "to present succinctly what is known about cosmic magnetic phenomena and attempt to coordinate it . . . to try to bring some clarity into a little known and very controversial subject." In accomplishing the first of these three objectives, the author is fairly successful, and consequently the two volumes serve a useful purpose for those who would like a summary of some of the literature in this field during the past few decades. Although the books are written in French, the style and language employed present little difficulty for an English reader who has a limited ability with that language.

The subject matter covers a very wide range. The first volume begins with an excellent presentation of the Störmer theory of the motion of high-energy charged particles in the field of a magnetic dipole and continues with discussions of the magnetic fields of the sun and stars, of the solar corona, and of the

zodiacal light. The second volume deals more fully with the magnetism of the earth—its origin, its variations, and its association with cosmic radiation—followed by two highly speculative chapters on magnetic phenomena associated with the moon and comets. In covering this wide field much of the material has been brought up to recent date, even including some of the current thinking on radio astronomy.

There are serious shortcomings in that the author has omitted much important research and has included much that is trivial and much that is not favorably regarded by outstanding investigators in the field. The interpretations that the author places on facts of observation and the conclusions that he draws regarding the nature and origin of the phenomena he describes are in many cases in disagreement with my opinions and those of others. For this reason, the reader is warned against accepting statements in these two volumes without critical examination.

A. G. McNish
National Bureau of Standards

Sponsored Research Policy of Colleges and Universities. A report of the Committee on Institutional Research Policy. American Council on Education, Washington 6, 1954. vii + 95 pp. $1.50.

The academic world, if not the general public, has been made increasingly aware that research, especially scientific research, is getting to be expensive business. An ever-increasing share of this expense is being borne by nonuniversity funds directed to universities. Two years ago, recognizing the problems growing out of these trends, the committee authoring the present report was appointed. It is refreshing to find a committee reporting so promptly and concisely.

The document is short and, although somewhat repetitious, it is interesting reading. According to it, universities, colleges, and such institutions exist to extend, conserve, and disseminate knowledge. They ". . . have a heavy responsibility to encourage the free exercise of intellectual curiosity . . ." without worrying overmuch about distinctions between basic and applied research. "It is crucial to the National Welfare that research in Educational Institutions be continued and increased, and sponsored research is indispensable to this end." However, it should be recognized that even the best of men and institutions may be tempted by the glitter of gold, and the report laudably warns against the dangers of diverting scholars from their basic ends. The report offers various examples of ways in which outside funds may be dangerous, while noting the desire of all concerned to contribute the maximum to the public good, in normal or in emergency times.

I think that the average reader would agree with me that the over-all impact of the book would be more accurately portrayed by the title "Fiscal Policy Related to Sponsored Research of Colleges and Universities." This is understandable since the committee was composed of men with varying but appreciable degrees of interest in matters of administration as contrasted with meeting classes or working in the laboratory. According to standard bibliographic references available to me, the "administrative quotient" (man-years administration/man-years teaching-research) approximates 1, but since the average tenure of the members in administrative posts is near 10 years, the academic aspects are necessarily more remote. A plea, to which I heartily subscribe, is made for administration and faculty to get together to arrive at a mutual understanding of fiscal (that is, overhead) problems.

Much of the report appears to assume an equivalence of contract-type support and grants-in-aid. To the committee, the major differences, as is noted in Chapter 5, would appear to be with respect to overhead. Referring to grants-in-aid: "Normally indirect costs under this system have ranged up to 15%. These policies and the grant-in-aid method, when carried out on an extensive scale, are held to be harmful by institutional representatives." Perhaps so, but I suspect that the average recipient of a grant-in-aid from the U.S. Public Health Service would be a little appalled to learn that he is harmful to his institution. Private foundations are gently chided for not allowing overhead; ". . . the Foundation grant cannot escape the criticism that it is imposing an undue burden on the educational institution by requiring it to participate in the cost of conducting the research covered by the grant-in-aid."

When the contractual policies of the Armed Services Procurement Regulations are spoken of by the committee with fondness, they signify approval of a system derived by modifications of procedures devised to procure material for our military units. Administration of research funds by officials of the various agencies of the Department of Defense has been, by and large, very acceptable to scientists, as witness the effective program of the Office of Naval Research. However, the fact that research can be handled this way does not mean that universities have to accept schemes devised for completely nonacademic purposes, for buying units of research unless they wish to. A recent Congressional committee report (Riehlman report) is considerably more illuminating with regard to the impact of armed forces policies on scientists than is the present report of the committee of the American Council on Education.

The committee remarks: "Basic research is analogous to a checking account in a bank. If such funds are withdrawn and not replaced, the account will soon be overdrawn." Prosecuting basic research is not analogous to depositing money in the checking account (p. 5) and the "account" is never "overdrawn." I fear the analogy used by the committee illustrates a point of view not uncommon in universities, including the policy of operating research as a personal-type checking account where the depositor is charged a fee for each unit.

Perhaps modern academic institutions must, for some reason not known to faculty members, regard research as a commodity subject to depletion by use and withdrawal. For my part, I like to think that when I study a sodium pump in frog muscles I am providing a minor facet of light in our existing body of knowledge that will endure and illuminate other problems and will lose its impact, not by being "overdrawn," but by being superseded by better research.

The report speaks rather longingly of what it terms "institutional non-project type" grants. Federally sponsored research in agriculture is offered as a desirable example. Although it is true that funds to land-grant colleges under the Morrill Act of 1890 amount virtually to free endowment, others (such as Hatch, Adams, and Bankhead-Jones) have varying degrees of limitation, may provide no overhead, and may carry "matching fund" clauses. Bankhead-Jones projects are also closely audited on a yearly basis. Thus, from the example offered it is hard to tell what the committee is approving as policy.

Policies more basic than fiscal are touched upon primarily with reference to a quotation from President Dodd's delightful remarks about "projectitis."

A committee of the National Science Board is currently studying matters related to the impact of outside funds on universities and colleges and it is to be hoped that, building on the present report, they can delve into matters of basic policy. Certainly university policy is being formed willy-nilly or otherwise, in large part because of the almost explosive intermingling of university scholars and fund-granting agencies over the past decade. In the life sciences alone thousands of grants-in-aid are made to scienitsts, mostly by foundations and agencies, which, in turn, rely in large part on the advice of hundreds of university scientists. The scholars themselves are thus squarely in the middle of an expanding program, not just on the receiving end. Administrative officials should take great

pains to insure a high degree of mutual understanding among themselves and this potent body of advisor-research workers. The present report speaks briefly of the vexing fear that the existence of much money for a given area of scholarship may distort a university or college program. There is the even more vexing, because unspoken, fear that scholars may come to be measured in terms of their grant money rather than their intellectual abilities.

It is a little startling to me to find the statement: "Research Grants however, and particularly those sponsored by the Federal Government, seem to be concentrated in a relatively few institutions of higher learning." The implication of this statement is that other institutions are neglected. So far as life sciences are concerned at least, federal funds do turn out, in fact, to be distributed roughly in proportion to academic populations of states. What more could be asked?

Since "sponsored research" deals mainly with scientific research, it is natural that the present volume is biased in that direction. Working next door to this scientific mountain may have profound effects on the life of a nonscientific researcher, and this deserves most serious attention within the educational world. It is indeed important that studies such as the one under consideration be carried out, that the results be published and widely discussed. To survive, the academic institution needs to know thoroughly what its aims and ideals really are and develop policies to achieve them.

I commend to the attention of the committee an earlier report (1605) on university policies contained in a volume entitled *The Advancement of Learning*. In it, Francis Bacon quotes Diogenes who, upon being asked "How it happened that Philosophers followed the rich, and not the rich the Philosophers?" replied "Because the Philosophers know what they want, but the rich do not."

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Introduction to the Theory of Neutron Diffusion. vol. 1. K. M. Case, F. de Hoffmann, and G. Placzek. Los Alamos Scientific Lab., Los Alamos, N.M., 1953. viii + 174 pp. Illus. Paper, $1.25. (Order from Supt. of Documents, GPO, Washington 25.)

This slim volume is based on a series of lectures given by G. Placzek in 1949 on methods of treating the one-velocity diffusion problem in homogeneous, isotropic media. It includes "Streaming in vacuum," "Purely absorbing media," "The equations for a general medium," "Uniform infinite medium with isotropic scattering," and "Application of the results obtained for the uniform infinite medium to the solution of finite problems." This last chapter, unfortunately, is cut off after a single application (to the source-free half-space). The remaining applications are promised in the projected volume II.

Although the subject matter is limited, it is basic and well chosen. The treatment is clear, detailed, and thorough. Included are many extremely useful tables and curves (for example, on the escape probabilities for uniform sources in purely absorbing media). Especially noteworthy and impressive is the thorough discussion of the approach to the asymptotic (diffusion) density in strongly absorbing media.

Bernard T. Feld
Department of Physics,
Massachusetts Institute of Technology

Structure of Molecules and Internal Rotation. San-Ichiro Mizushima. Physical chemistry, a series of monographs. Eric Hutchinson, Ed. Academic Press, New York, 1954. x + 244 pp. Illus. $6.

The work discussed in this book is closely related to that of Mizushima and his colleagues at the University of Tokyo during the past two decades. The book is organized into two parts, the first of which deals with a description of the development of the investigations on internal rotation. The second part presents a more detailed explanation of some of the theoretical aspects of the problem and a description of experimental methods.

Ethane and its derivatives are treated in considerable detail. A summary is given of the results of investigations using infrared absorption, Raman scattering, dipole moment data, electron diffraction, and heat-capacity measurements. The interpretation of these studies is developed to show support for the model that describes the liquid and gas phases as consisting of a mixture of *trans* and *gauche* rotational isomers. The *trans* form seems, in general, to be stabilized in the crystalline state. The influence of internal hydrogen bonding is briefly covered, and the nature of the potential barrier hindering internal rotation is discussed in connection with the treatment of thermal data.

A chapter is devoted to simple molecules, other than ethane derivatives, that may show internal rotation. Rotational, or orientational, isomerism in cyclic molecules is also treated. The remainder of part I is devoted to a discussion of more complicated systems, such as long-chain hydrocarbons, polypeptides, and related compounds. The various possibilities of extended, folded and helical peptide chain structures are discussed in terms of rotational orientation about appropriate bonds. Experimental evidence for one or another of these structures in specific proteins is cited.

Part II begins with a description of several experimental techniques used or developed by the group at the University of Tokyo. A brief introduction to the theory of normal vibrations is followed by application to special cases involving torsional oscillation, again with emphasis on ethane derivatives. One section is devoted to the vibrations of long-chain molecules, and one to sum and product rules applicable to rotational isomers. Finally, the analysis of the Raman and infrared spectra of dichloroethane is given as an example.

The book constitutes an interesting introductory account of the application of studies in infrared and Raman spectroscopy to simple molecules having internal rotational or torsional vibrational degrees of freedom. The possible extension of these results and/or techniques to the elucidation of structures for more complex molecules is discussed and illustrated by some examples.

Paul C. Cross
University of Washington
Department of Chemistry,

The Structural Chemistry of Proteins. H. D. Springall. Academic Press, New York; Butterworths, London, 1954. x + 376 pp. Illus. $6.80.

The author states that this book grew out of a course of lectures given to undergraduates in the final year of an "Honours School of Chemistry" and to postgraduate research workers. After an introduction defining the biological importance of the proteins and considering the amino acids derived by hydrolysis, Springall discusses successively the chemical methods of peptide synthesis, the fibrous proteins, the globular proteins, and finally the analytic chemistry of the proteins and amino acids. Each chapter has a self-contained bibliography, and there are author and subject indexes as well as an index of "named" proteins and peptides. Each chapter has a reasonably detailed introductory summary of its subject, which should serve to orient the student in the subject and its literature.

The chapters on fibrous and globular proteins contain discussions of physicochemical methods applicable to proteins including x-ray and electron beam diffraction, infrared and ultraviolet absorption, electrophoresis and sedimentation. The relationship of these studies to molecular sizes and shapes and to the various detailed models of folded, pleated and helical peptide chains is clearly stated.

The chapter on analytic chemistry of proteins and amino acids sets forth the various methods used for the estimation of amino acids in hydrolyzates, as well as the newer methods for sequence determination, and discusses the results of these, always with the thought expressed or implied that knowledge of the "covalent" sequences is basic to an understanding of the biological nature of proteins. The book properly emphasizes that, upon this covalent structure, a noncovalent specific structure characterizes proteins, especially the globular group.

No consideration is given to ion binding by proteins, except insofar as hydrogen-ion binding is a tool in analytic determination, and the description of denaturation phenomena is skimpy.

The book should be valuable as a guide to chemistry majors who have had standard organic and physical chemistry courses, to chemists who are not familiar with its field, and to biologists who would like to know what the chemists are talking about.

MILTON LEVY
Department of Biochemistry, New York University College of Medicine

A Short Textbook of Colloid Chemistry. B. Jirgensons and M. E. Straumanis. Wiley, New York; Pergamon, London, 1954. (Rev. version of *Kurzes Lehrbuch der Kolloidchemie,* 1949.) xvi + 420 pp. Illus. $8.

This little book is a completely revised version of the authors' *Kurzes Lehrbuch der Kolloidchemie,* which was published in 1949. The short first part concerns itself with defining the colloid field of physical chemistry and with the definitions and classifications needed for its understanding. The reader of the first part will acquire only a superficial knowledge of the subject.

The larger second section of the book is filled with a vast amount of experimental facts on colloids, together with statements of the applicable theories. The authors leave one with the impression that they have not left out a single bit of information that they considered at all useful. There is a good deal of very recent matter presented in a rather convincing manner. However, the whole subject fails in logical development. For example, chapters 9–11 concern themselves with the size, shape, and structure of colloids, and these are followed by one on the preparation of such systems. Again thixotropy, a colloidal process, is briefly discussed in a section following that on mechanical properties of polymers when it ought to appear under coagulation. A student would grasp the subject far better if it were presented without so many facts but in a logical manner—that is, all work on colloidal processes following a full knowledge of the properties of colloids and their extended surfaces.

The book is well illustrated and will be useful as a source of much factual information. Some authors' names are spelled incorrectly, and the initials of several are incorrect. However, the format makes for easy reading.

LLOYD H. REYERSON
School of Chemistry,
University of Minnesota

New Books

Time's Arrow and Evolution. Harold F. Blum. Princeton Univ. Press, Princeton, N.J., ed. 2, 1955. 219 pp. $4.50.

Seashores. A guide to shells, sea plants, shore birds, and other natural features of American coasts. Herbert S. Zim and Lester Ingle. Simon & Schuster, New York, 1955. 160 pp. Paper, $1; cloth, $1.95.

Grassland Farming. George H. Serviss and Gilbert H. Ahlgren. Wiley, New York; Chapman & Hall, London, 1955. 146 pp. $2.96.

Lehrbuch und Atlas der Anatomie des Menschen. Band II, *Eingeweide Nervensystem-Sinnesorgane.* Fr. Kopsch. Thieme, Stuttgart, Germany, 1955 (U.S. distrib.: Intercontinental Medical Book Corp., New York 16). 768 pp. $15.35.

Introduction to Social Welfare. Walter A. Friedlander. Prentice-Hall, New York, 1955. 683 pp. $9.

The Genus Nicotiana. Origins, relationships and evolution of its species in the light of their distribution, morphology and cytogenetics. Thomas Harper Goodspeed. Chronica Botanica, Waltham, Mass.; Stechert-Hafner, New York, 1954. 536 pp. $12.50.

Origins of Resistance to Toxic Agents. A symposium. M. G. Sevag, Roger D. Reid, and Orr E. Reynolds, Eds. Academic Press, New York, 1955. 471 pp. $12.

The Human Adrenal Cortex. Ciba Foundation Colloquia on Endocrinology, vol. VII. G. E. W. Wolstenholme and Margaret P. Cameron, Eds. Little, Brown, Boston, 1955. 665 pp. $10.

Bergsonian Philosophy and Thomism. Jacques Maritain. Trans. by Mabelle L. Andison and J. Gordon Andison. Philosophical Library, New York, 1955. 383 pp. $6.

Machine Translation of Languages. Fourteen essays. William N. Locke and A. Donald Booth, Eds. Massachusetts Inst. of Technology, Cambridge; Wiley, New York; Chapman & Hall, London, 1955. 243 pp. $6.

Analysis of Insecticides and Acaricides. A treatise on sampling, isolation, and determination, including residue methods. Francis A. Gunther and Roger C. Blinn. Interscience, New York–London, 1955. 696 pp. $14.

Information Processing Equipment. M. P. Doss, Ed. Reinhold, New York, 1955. 270 pp. $8.75.

Astronomical Cuneiform Texts. vol. I, *Introduction the Moon,* 278 pp.; vol. II, *The Planets Indices,* 233 pp.; vol. III, *Plates.* O. Neugebauer, Ed. Lund Humphries, London, 1955. £5 5s. per set.

The Roger Adams Symposium. Papers presented at a symposium in honor of Roger Adams at the Unversity of Illinois, Sept. 3–4, 1954. Wiley, New York; Chapman & Hall, London, 1955. 140 pp. $3.75.

Der Briefwechsel von Johann Bernoulli. Band I. Herausgegeben von der naturforschenden gesellschaft in Basel. Birkhauser, Basel, 1955. 531 pp.

The Gifted Student as Future Scientist. Paul F. Brandwein. Harcourt, Brace, New York, 1955. 107 pp. $2.

The Collected Works of George Abram Miller. vol. IV. Univ. of Illinois, Urbana, 1955. 458 pp. $7.50.

Handbook of Food and Agriculture. Fred C. Blanck, Ed. Reinhold, New York; Chapman & Hall, London, 1955. 1039 pp. $12.50.

Theory of Functions of a Real Variable. I. P. Natanson. Trans. by Leo F. Boron and Edwin Hewitt. Ungar, New York, 1955. 277 pp. $6.50.

Chemistry of Carbon Compounds. vol. III, pt. A, *Aromatic Compounds.* E. H. Rodd, Ed. Elsevier, New York–London, 1954. 685 pp. $17.50.

Approximations for Digital Computers. Cecil Hastings, Jr., Jeanne T. Hayward, and James P. Wong. Princeton Univ. Press, Princeton, 1955. 201 pp. $4.

Personal Adjustment and Mental Health. Alexander A. Schneiders. Rinehart, New York, 1955. 587 pp. $5.

Annual Review of Plant Physiology. vol. 6. Daniel I. Arnon, Ed. Annual Reviews, Stanford, Calif., 1955. 505 pp. $7.

Ancient Education. William A. Smith. Philosophical Library, New York, 1955. 309 pp. $3.75.

The Biology of a Marine Copepod *Calanus finmarchicus* (Gunnerus). S. M. Marshall and A. P. Orr. Oliver & Boyd, London, 1955. 188 pp. 21s.

Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, *but to the publisher or agency sponsoring the publication.)*

Transactions of the American College of Cardiology. vol. IV, 1954. Simon Dack and Bruno Kisch, Eds. The College, New York, 1955. 319 pp.

Astronomy. Vocatonal and professional monograph. No. 72. Freeman D. Miller. Bellman, Cambridge, Mass., 1955. 32 pp. $1.

An Engineering Interpretation of the Economic and Financial Aspects of American Industry. vol. XI, *The Automotive Industry.* George S. Armstrong & Co., Inc., New York, 1955. 87 pp.

Some Polyclad Flatworms from the West Indies and Florida. vol. 104, No. 3341. Libbie H. Hyman. Smithsonian Institution, Washington, 1955. 35 pp.

Footing the Hospital Bill. Pamphlet No. 222. Elizabeth Ogg. Public Affairs Pamphlets, New York, 1955. 28 pp. $0.25.

The Ford Foundation Report 1954. The Foundation, New York, 1955. 114 pp.

Scientific Meetings

Nuclear Emulsion Research

The Conference on Cooperative Nuclear Emulsion Research was held at DePauw University in Greencastle, Ind., on 31 Mar. and 1–2 Apr. Of the 71 physicists who attended, 60 came from colleges and universities, with this number about equally divided between small and large institutions. The remaining 11 persons represented government agencies and industrial and national laboratories. The conference participants came from nearly all sections of the United States, and two came from Canada.

The purpose of the conference was to explore problems related to the establishment and operation of cooperative research programs between the laboratories actively engaged in nuclear emulsion research and the college physicist who would like to undertake such research. Two years ago Amherst College and the National Science Foundation sponsored a conference at Amherst at which 25 college physicists broadly considered the general question of physics research in colleges. The report of the Amherst conference, which has been widely circulated, made the unanimous recommendation that physics research in colleges be encouraged. The Amherst report also proposed ways of supporting such research, listed benefits to be achieved from it, and suggested certain criteria for investigations suited to the general climate of the small college.

The DePauw conference discussed the practicability of nuclear emulsion techniques for physics research at the small college. Also considered were the various aspects of such research as it might be carried out in cooperation with an established laboratory. How this laboratory could offer aid in exposing and processing emulsions and instruction and advice in analysis procedures without at the same time reducing the small college physicist to "slave satellite" status was well aired.

The program and the arrangements for the conference were set up by the Steering Gommittee, cochaired by Marcel Schein (University of Chicago) and Malcolm Correll (DePauw University). The other members of the Steering Committee were Fay Ajzenberg (Boston University), M. F. Kaplon (University of Rochester), R. R. Palmer (Beloit College), Chaim Richman (University of California, Berkeley), and E. O. Salant (Brookhaven National Laboratory). J. Howard McMillen (National Science Foundation) worked closely with this committee, and the success of the conference is due in no small measure to his interest and assistance.

The formal program included: "Introduction of the conference," McMillen; "Summary of results achieved by nuclear emulsion techniques," Schein; "Structure and performance of nuclear track emulsion," John Spence (Eastman Kodak); "The processing and control of nuclear track emulsion," Arthur Beiser (New York University); "Microscopes and accessories," W. F. Fry (University of Wisconsin); "Accessory experimental equipment," Gus T. Zorn (Brookhaven National Laboratory); "Balloon techniques," John E. Naugle (University of Minnesota); "Minimum facilities for nuclear emulsion research," Schein; "Experiences with cooperative nuclear emulsion research," K. E. Davis (Reed College), Aaron Lemonick (Haverford College), A. D. Sprague (DePauw University); "Cosmic-ray work with nuclear emulsions," Kaplon; "Nuclear emulsion research with accelerators of intermediate energies," Louis Rosen (Los Alamos Scientific Laboratory); "Nuclear emulsion research with the cosmotron," Salant; "Nuclear emulsion research with the bevatron," Marian Whitehead (University of California, Berkeley).

Considerable time was allowed within the program for discussions from the floor. These valuable contributions are embodied in the following observations and recommendations, which, at the closing luncheon, received the unanimous approval of the conference.

1) It is the belief of this conference that nuclear emulsion programs of cooperative research between colleges and large research centers should be expanded. Active research stimulates the instructor and thereby makes him a more inspiring teacher by permitting him to contribute in an original manner to his chosen field. It serves to develop enthusiasm among students. It enables a college to attract and to retain a superior faculty and better students. Research with nuclear emulsions is particularly well suited to cooperative programs in colleges. Research centers are eager to share their facilities for work with nuclear track plates with interested researchers in other institutions. Significant research can be accomplished in studying such plates in colleges with limited facilities. Such programs have already demonstrated their value and could most profitably be extended to other institutions.

2) The conference concluded that universities and national laboratories would benefit from an expanded cooperative research program and would indirectly benefit from the stimulated students who would later seek careers in physics via the graduate schools of the universities.

3) It is recognized that this cooperative research, to serve its purpose as a necessary adjunct to a well-rounded physicist, must be of a meaningful nature. In addition there exists the requirement that for its adaptation by liberal arts colleges it must not require large financial expenditures. It is the belief of the conferees that basic research using nuclear emulsion techniques satisfies both of these requirements to a high degree. There exist large classes of problems in nuclear physics covering the entire energy spectrum from 1 Mev to the highest energies in the cosmic radiation that can be undertaken with a minimum amount of equipment by a small staff and yet lead to meaningful and significant physical results, representing a real contribution to knowledge.

4) It was felt that the participation of undergraduates in cooperative research is beneficial and should be encouraged. However it is suggested that, for students, the physics rather than the purely technical aspects of the research problem be emphasized.

5) It was recognized that, in order that cooperative research be carried out successfully by college physicists, it is absolutely essential that adequate time be made available. In some cases this can be accomplished only by decreasing teaching loads. In order to maintain effective cooperation, it is also imperative that means for frequent visits to the cooperating institution be provided. Although some colleges may not be able to make substantial financial contribution to these programs, they could share in the activity by giving such arrangements their whole-hearted support.

6) Many college teachers find it difficult to get started in the rewarding field of nuclear emulsion research because of their need for information about recent research developments and specialized techniques. It is recommended therefore that summer institutes be established to instruct college teachers in current nuclear emulsion research techniques and to review knowledge in relevant fields of modern physics.

A more comprehensive digest of the proceedings of the conference is being

prepared by members of the Steering Committee. Requests for this should be addressed to Malcolm Correll, Department of Physics, DePauw University, Greencastle, Ind.

MALCOLM CORRELL
DePauw University,
Greencastle, Indiana

■ The science section of the Royal Society of Canada held its annual meeting at Toronto, 6–8 Jun. Contributed papers were distributed under the usual subsections of mathematics, chemistry, nuclear physics, spectroscopy, and general physics.

The presidential address was one of the three papers forming an astrophysics symposium pertaining to distance measurement and galactic structure. Another symposium devoted to problems in meteorology produced discussions between the professional meteorologists on the one hand and physicists and mathematicians on the other.

A third symposium, arranged jointly with the geological sciences section of the society, was devoted to discussions of geochronology and geophysics. The papers in this symposium provided a comprehensive review of the various methods of age determination currently used in Canada. The complete program of 119 papers presented a cross-section of the types of research being actively pursued in the various Canadian centers.

■ The Society for Industrial and Applied Mathematics will hold its 2nd general meeting at the University of Michigan, 30 Aug.–1 Sept. Invited speakers include Max A. Woodbury, Francis P. Callahan, Lofti Zadeh, Gerald L. Thompson, Richard Bellman, T. H. Berlin, and Yudell L. Luke.

Other societies that have scheduled meetings at the University of Michigan during the week of 29 Aug. are the American Mathematical Society, the Association for Symbolic Logic, the Econometric Society, the Institute for Mathematical Statistics, the Mathematical Association of America, and the Pi Mu Epsilon Fraternity.

■ The technical division of Tracerlab, Inc., Boston, Mass., is sponsoring a Symposium on Applications of Radioactivity in the Food and Food Processing Industries that is to be held at the Sheraton Plaza Hotel, Boston, 19–21 Oct. This is the second in a series of symposiums on the industrial applications of radioactivity sponsored by Tracerlab. The primary objective of the meeting will be to acquaint members of the food and food processing industries with the uses of radioisotopes in research, development, and process control.

The first day will be devoted to orientation talks directed to those persons who are contemplating the use of radioisotopes. There will be lectures on the fundamentals of radioactivity, establishing a radioactivity laboratory, Atomic Energy Commission regulations, health physics problems, training of personnel, and other basic topics.

The second and third days will be taken up by the presentation of technical papers by speakers from industry, academic research institutions, and the Atomic Energy Commission and other Government agencies. For information, address the Symposium Committee, Technical Division, Tracerlab, Inc., 130 High St., Boston 10, Mass.

■ A Conference on Low Temperature Physics and Chemistry is to be held at Louisiana State University under the auspices of the university and the National Science Foundation, 28–30 Dec. The members of the steering committee for the conference are F. G. Brickwedde, S. C. Collins, J. G. Daunt (chairman), E. A. Long, J. H. McMillen (NSF representative), J. M. Reynolds (L.S.U. representative), and C. F. Squire.

The topics for discussion will include, but will not be confined to, (i) liquid and solid helium; (ii) superconductivity; (iii) ionic and nuclear paramagnetism and magnetic cooling; (iv) electronic and thermal properties, and others, of metals at low temperatures. Those wishing to attend and/or read a paper should write to Dr. J. M. Reynolds, Department of Physics, Louisiana State University, Baton Rouge, La.

The deadline for submission of abstracts of papers to be included in the conference is *28 Oct.* Contributions should be as brief as possible and should be descriptions of work in progress rather than surveys of particular fields. A program, including abstracts, will be distributed to the participants before the opening of the conference.

■ The 7th fall meeting of the American Physiological Society will be held at Tufts College, Medford, Mass., 6–9 Sept. A feature of the program will be the lectures and conferences on the "Teaching of fluids, electrolytes and acid-base." On 9–10 Sept. the APS will meet with the Society of General Physiologists at Woods Hole, Mass. For further information address the Local Committee, American Physiological Society, Department of Biology, Tufts College, Medford 55, Mass.

■ The 4th National Clay Conference, sponsored by the Clay Minerals Committee of the National Research Council, will be held 10–13 Oct. at Pennsylvania State University as part of the university's centennial activities. Arrangements have been made for several scientists from Europe and Asia to attend and present papers. In the past, the conference has attracted a diverse group of scientists, ranging from colloid chemists and ceramists to mineralogists and soil scientists. For information write to the chairman of the local committee, Prof. T. F. Bates, College of Mineral Industries, Pennsylvania State University, University Park, Pa.

■ The International Society of Vegetative Neurology will hold its 6th annual symposium at Strasbourg, France, on 29 Sept.–1 Oct. The theme is "Peripheral vascular regulation." For information, write to Prof. R. Fontaine, University of Strasbourg Faculty of Medicine, or to Prof. Carmen Coronini, Editor of *Acta Neurovegetativa*, Springer-Verlag, Alserstrasse 32/I/13, Vienna, Austria.

Society Elections

■ Common Cold Foundation: chairman, O. Parker McComas, Philip Morris & Co., Ltd., Inc., New York; honorary chairman, Edgar Mayer, New York University; pres., John P. Syme, Johns-Manville Corp., New York; sec., Leighton Coleman, Davis, Polk, Wardwell, Sunderland, and Kiendl, New York; asst. sec., Parker Bailey, Davis, Polk, Wardwell, Sunderland, and Kiendl; treas., Gilbert H. Perkins, Chemical Corn Exchange Bank, New York; asst. treas., Pierce Onthank, Chemical Corn Exchange Bank. The vice presidents are M. H. Manson, American Telephone and Telegraph Co., New York; Benjamin H. Namm, Namm-Loeser's, Brooklyn, N.Y.; and William A. Sawyer, industrial medical consultant, Rochester, N.Y.

■ American Society for Artificial Internal Organs: pres., W. J. Kolff, Cleveland, Ohio; pres.-elect, Clarence Dennis, Brooklyn, N.Y.; sec., P. F. Salisbury, Institute for Medical Research, Cedars of Lebanon Hospital, Los Angeles, Calif.

■ Harvard Medical School Association: pres., Joseph T. Wearn, Western Reserve University; pres.-elect, George Denny, Boston; v. pres., Richard Capps, Chicago; sec., James Jackson, Brookline Mass.; treas., John R. Brooks, Wellesley, Mass.

■ The Chemical Institute of Canada: pres., Roger Gaudry, Ayerst, McKenna and Harrison, Ltd., Montreal; v. pres., Clifford B. Purves, McGill University.

Erratum: In the issue of 17 June, page 11A, the International Congress of Anthropological and Ethnological Sciences, 5th, was mistakenly announced for 2–9 Sept. This meeting will take place in 1956, not 1955.

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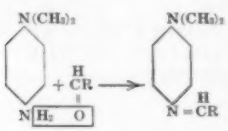

For aromatic aldehydes, the resultant anils come out immediately in crystals of characteristic form, color, and melting point. For most of the aliphatic aldehydes, the anils must be extracted from solution with 30% acetic acid. So confident are the authors of the insensitivity of the reaction to ketones that they sometimes use acetone as their solvent. We can supply an abstract of their procedure without obligation.

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K's grandson

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has been progress in spring motors: one winding of the *K-100* can pull 40 feet of film. All manner of cinematic changes can be rung—slow motion up to 64 frames per second, one frame at a time for animation, up to two feet of reversed travel by hand crank (as an extra). The finder is a genuine focusing telescope that shows adjacent areas as well as field coverage. Gears are of quiet, long-wearing nylon, driven on ball-bearing mounted shafts. Film gate pressure adjusts automatically to camera speed. The ball-mounted pull-down mechanism can accommodate single-perforated film for sound recording.

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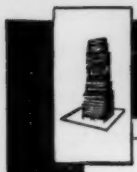

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Forthcoming Events

August

8–10. Inst. of Aeronautical Sciences, Seattle, Wash. (S. P. Johnston, IAS, 2 E. 64 St., New York 21.)

8–13. International Council of Scientific Unions, Oslo. (Administrative Secretariat, ICSU, 29 Tavistock Sq., London, W.C.1.)

8–20. International Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland. (W. G. Whitman, Room 3468, United Nations, New York.)

12–17. Canadian Teachers' Federation, Ottawa. (G. G. Croskery, 444 MacLaren St., Ottawa, Ont.)

15–16. Operations Research Soc. of America, 7th national, Los Angeles, Calif. (R. A. Bailey, Military Operations Research Div., Lockheed Aircraft Corp., Burbank, Calif.)

15–18. American Veterinary Medical Assoc., Minneapolis, Minn. (J. G. Hardenbergh, 600 S. Michigan Ave., Chicago 5, Ill.)

15–19. American Inst. of Electrical Engineers, Pacific general, Butte, Mont. (N. S. Hibshem, 33 W. 39 St., New York 18.)

15–19. American Soc. of Agronomy and the Soil Science Soc. of America, joint meeting, Davis, Calif. (L. G. Monthey, 2702 Monroe St., Madison 5, Wis.)

15–19. Plant Science Seminar, 32nd annual, Gainesville, Fla. (C. H. Johnson, School of Pharmacy, Univ. of Florida, Gainesville.)

15–20. International Dental Federation, 43rd annual, Copenhagen, Denmark. (W. R. Klausen, 1 Alhambravey, Copenhagen V.)

17–24. Australian and New Zealand Assoc. for the Advancement of Science, 31st, Melbourne, Australia. (J. R. A. McMillan, ANZAAS, Science House, 157 Gloucester St., Sydney, N.S.W. Australia.)

17–9. Canadian Mathematical Cong., 5th summer seminar, Winnepeg, Manitoba. (Secretariat, CMC, Chemistry Bldg., McGill Univ., Montreal.)

19–28. International Conf. of Agricultural Economists, Helsingfors, Finland. (J. R. Currie, Dartington Hall, Totnes, Devonshire, Eng.)

19–30. National Assoc. of Biology Teachers, Ann Arbor, Mich. (P. V. Webster, Bryan City Schools, Bryan, Ohio.)

22–23. Electronics and Automatic Production Symposium, San Francisco, Calif. (W. D. McGuigan, Stanford Research Inst., Palo Alto, Calif.)

22–9. Wool Textile Research Conf., Sydney, Australia. (F. G. Nicholls, Commonwealth Scientific and Industrial Research Organization, 314 Albert St., East Melbourne, Australia.)

20–31. American Physical Soc., Mexico City, Mexico. (K. K. Darrow, Columbia Univ., New York 27.)

29–2. Infrared Spectroscopy Inst., 6th annual Nashville, Tenn. (N. Fuson, ISI, Fisk Univ., Nashville 8.)

29–2. International Assoc. for Hydraulic Research, 6th plenary, Delft, Netherlands. (L. G. Straub, St. Anthony Falls Hydraulic Lab., Minneapolis 14, Minn.)

29–3. Mathematical Assoc. of America, Ann Arbor, Mich. (H. M. Gehman, Univ. of Buffalo, Buffalo 14, N.Y.)

29–5. International Astronomical Union, Dublin, Ireland. (P. T. Oosterhoff, IAU, Leiden Observatory, Leiden, Netherlands.)

29–6. International Horticultural Cong., 14th, The Hague, Netherlands. (G. de Bakker, International Comm. for Horticulture, Bezuidenhoutseweg 30, The Hague.)

30–31. Soc. for Industrial and Applied Mathematics, 2nd general, Ann Arbor, Mich. (G. W. Preston, Research Div., Philco Corp., Tioga and C Streets, Philadelphia 34, Pa.)

30–2. American Mathematical Soc., 60th summer, Ann Arbor, Mich. (AMS, 80 Waterman St., Providence 6, R.I.)

30–2. Biological Photographic Assoc., 25th annual, Milwaukee, Wis. (L. C. Massopust, Sr., Marquette Univ. School of Medicine, 561 N. 15 St., Milwaukee 3.)

31–1. Conf. on Low Temperature Physics, Paris, France. (L. Weil, Institut Fourier, Place du Doyen Gosse, Grenoble, Isère, France.)

31–2. American Sociological Soc., Washington, D.C. (W. J. Warner, ASS, New York Univ., Washington Sq., New York 3.)

31–3. United Chapters of Phi Beta Kappa, 24th triennial, Minneapolis, Minn. (C. Billman, 1811 Q St., NW, Washington 9.)

31–7. British Assoc. for the Advancement of Science, annual, Bristol, Eng. (BAAS, Burlington House, London, W.1.)

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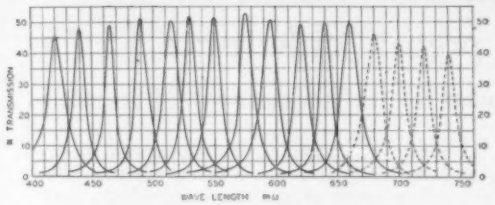

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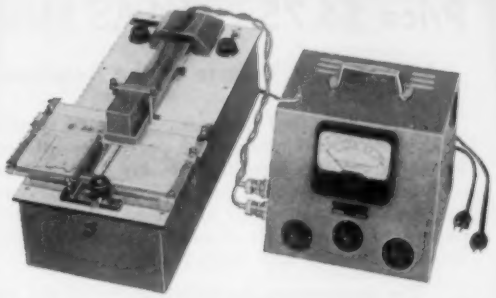

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CONTENTS

Production and Evaluation of Experimental Animal Caries: A Review
ERLING JOHANSEN, University of Rochester, and PAUL H. KEYES, National Institute of Dental Research

Location of Experimental Caries on Different Tooth Surfaces in the Norway Rat
ROBERT M. STEPHAN and M. RACHEL HARRIS, National Institute of Dental Research

Genetic Factors in Experimental Rat Caries
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Developmental Factors in Experimental Animal Caries
JAMES H. SHAW and REIDAR F. SOGNNAES, Harvard School of Dental Medicine

Dietary Factors in Experimental Rat Caries
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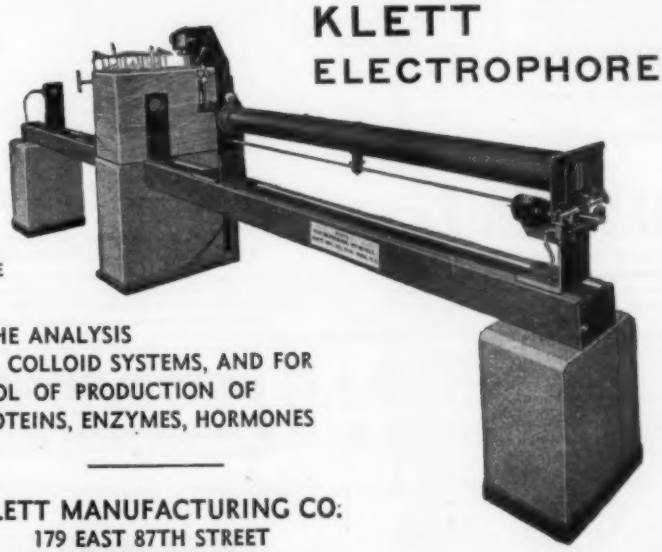

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International Centrifuges for Rapid Separation — Clarification — Filtration

Centrifugal Baskets

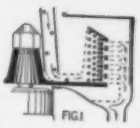


FIG.1

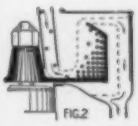


FIG.2

Basket heads furnish an ideal solution to the problem of separating medium-sized batches of suspensions and emulsions which are difficult to handle. Separations are accelerated by the application of from 870 to 1900 times the force obtained in a gravity filtration or sedimentation. Material flow when using a perforated basket lined with filter paper to separate a slurry is shown in Figure 1. The use of a solid basket to clarify a liquor of a heavier solid or liquid contaminant is illustrated in Figure 2.

FOR BENCH SCALE LABORATORY APPLICATIONS

Chemical Model — 5-Inch Baskets

Models for Hazardous or Non-hazardous Locations

Chemical Model

Interchangeable solid or perforated baskets available in porcelain, bronze, monel, stainless steel and rubber-covered steel. The centrifuge can be operated continuously until the 300 ml. cake capacity of basket is reached.

A total of 13 other heads for centrifuging material held in tubes (0.5 to 50 ml.) are also usable on the Chemical Model.

FOR LABORATORY OR PILOT PLANT APPLICATIONS

Model U Centrifuge — 5, 8 and 11 Inch Baskets

For Non-hazardous Locations

Model U Cabinet type Centrifuge

Interchangeable solid or perforated baskets available in bronze or stainless steel (other materials to order). The centrifuge can be operated continuously until the cake capacity of the basket is reached. Operating capacities and characteristics of the various sized baskets are as follows:

Basket Dia.	*Cake Cap.*	*Max. R.P.M.*	*Max. Force*
5 inch	300 ml.	4000	1130 x G.
8 inch	1500 ml.	3500	1390 x G.
11 inch	3000 ml.	3500	1900 x G.

A total of 39 other heads for centrifuging material held in tubes or bottles (10 to 600 ml. capacity) are also usable on the Model U Centrifuge.

Model BE50 Centrifuge — 5, 8 and 11 Inch Baskets

For Class I, Group D Locations

Model BE50 Explosion-proof Centrifuge

Interchangeable solid or perforated baskets available in bronze or stainless steel (other materials to order). The centrifuge can be operated continuously until the cake capacity of the basket is reached. Operating capacities and characteristics of the various sized baskets are as follows:

Basket Dia.	*Cake Cap.*	*Max. R.P.M.*	*Force*
5 inch	300 ml.	3500	870 x G.
8 inch	1500 ml.	3500	1390 x G.
11 inch	3000 ml.	3500	1900 x G.

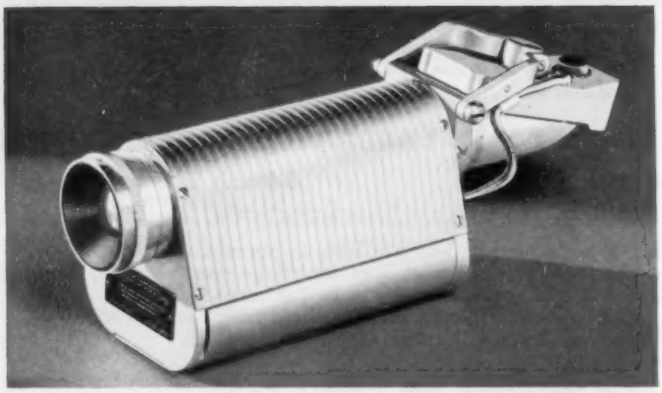
A total of 32 other heads for centrifuging material held in tubes or bottles (10 to 600 ml. capacity) are also usable on the Model BE50.

Size 3, Model FS — 14-Inch Baskets

Models for Hazardous or Non-hazardous Locations

Interchangeable solid or perforated baskets are available in bronze (other materials to order). The centrifuge can be operated continuously until the 11.5 liter cake capacity of the basket is reached. At the maximum basket speed of 2500 r.p.m. a force of 1250 x G is available to effect the desired separation. Three other heads for centrifuging material held in tubes or bottles (10 to 1300 ml. capacity) are also usable on the Size 3, Model FS Centrifuge. Send for descriptive Bulletin L.

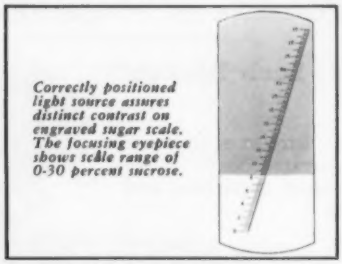
When to Pick or Pack? *Know in Seconds!*



New AO Hand Refractometer Determines Dissolved Solids Instantly!

Here's real news for food processors and growers! With AO's new Hand Refractometer accurate readings of the percentage of dissolved solids, particularly sucrose, are made on the spot . . . instantly!

Gone is the need for any reference to a thermometer or to temperature correction tables. The secret? AO's design engineers have simplified the temperature correction procedure by means of



Correctly positioned light source assures distinct contrast on engraved sugar scale. The focusing eyepiece shows scale range of 0-30 percent sucrose.

an exclusive, internal compensating device. Now operation is simple. Only a few drops of a sample need to be placed on the surface of the measuring prism. Using either transmitted or reflected light, the refractometer provides *immediate readings* from an internal graduated scale (range: 0-30 percent sucrose) which is visible through the focusing eyepiece. Accuracy is assured to 0.1 percent.

A built-in light source assures ideally positioned illumination under all conditions. Made of anodized aluminum, the new refractometer is light weight, easy to clean. An ever-ready top grain leather carrying case permits use of

Light wherever you go! Opening on underside of carrying case shows thumb button for built-in light source

instrument without removal from case.

If you test raw products for ripeness; if you process fresh juices, syrups, tomatoes, etc., write Dept. S-1, American Optical Company, Buffalo 15, New York, for complete information on the new Refractometer. Ask for CATALOG L20.

American Optical

INSTRUMENT DIVISION, BUFFALO 15, N. Y.